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# Europe Report

## SCIENCE AND TECHNOLOGY

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17 OCTOBER 1986

EUROPE REPORT

SCIENCE AND TECHNOLOGY

WEST EUROPE

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## WEST EUROPE/ADVANCED MATERIALS

### EURAM: EUROPEAN RESEARCH ON ADVANCED MATERIALS

#### Program Description

Brussels RESEARCH ACTION PROGRAMME MATERIALS IV. ADVANCED MATERIALS in English 1985 pp IV-2 through IV-20

[Text]

#### I. INTRODUCTION

The technological upheaval which the manufacturing industry is undergoing is a constant factor in the European economy now that the century is drawing to a close. It has been magnified and accelerated by the necessity to save energy, the urgent need to preserve the environment, to check the consumption of strategic materials, as well as the pressing imperative to boost Europe's competitiveness on the world market. In this context, materials occupy pride of place and will always play an essential role. The scientific and technical progress linked with materials will have a considerable effect on the expansion, or contraction, of certain major industries up to the year 2000. Novel materials do, indeed, have a direct effect on the progress made by sectors such as motor vehicles, aerospace, shipbuilding, railways, electronics, telematics, building, energy production, civil engineering, the biomedical sector and many others.

However, as in other high technology disciplines, European industry is falling badly behind in both the development and use of new materials. The situation in which Europe now finds itself of being technologically dependent on the United States and Japan for certain sophisticated materials will in the longterm threaten its future competitiveness.

The EURAM programme of in-depth R&D on advanced materials advocated below is intended precisely to provide a strong impetus to European science and materials engineering in order to rectify a declining situation.

#### II. EURAM - Definition - Aims

The EURAM programme aims to combine basic materials research with the "engineering" development of advanced materials upstream of the manufacturing industries, in order to help raise the technological level of their products and thus help them compete better on world markets. This means the creation, development and use of new materials and the upgrading of more conventional materials to a higher level of sophistication.

By the term "Advanced materials" the idea is conveyed of a sophisticated product with enhanced physical/chemical and mechanical properties offering high performance and capable of fulfilling one or more specific functions. Thus an advanced material such as the engineering ceramic known as Si-Al-ON differs very clearly from a conventional porcelain, whose practical limitations are well-known.

A materials R&D programme intended to achieve anything has to be conceived in practical terms. Since the field covered by materials is far too vast and complex to be tackled in one blow and since, moreover, the funds available impose restrictions, it is necessary to assign priorities in order to pick out the specific research sectors likely to provide a technological break-through.

In more general terms the EURAM programme takes account of the existence of the national programmes in order to provide cohesion between complementary activities. Furthermore, any duplication of research projects between EURAM and BRITE will be avoided by the Commission services.

The topics covered by the EURAM programme were carefully selected after detailed consultations with the industries concerned and with the CREST Subcommittee on Raw Materials and Other Materials.

### III. THE ROLE OF MATERIALS IN THE ECONOMY

"Materials" are an integral part of technological progress and have always been so. In the distant past, materials such as stone, copper, bronze and iron were milestones in human evolution. Materials will continue to play a predominant role as they constitute an essential link in the chain of technological innovation on a par with electronics and data processing. It is with advanced materials and their rational use that industrial companies will be able to improve the performance of their products and thus make them more competitive. In more general terms, new materials will be indispensable in providing workable solutions to a number of weighty problems now arising as this century draws to an end. These are:

- the rational use of raw materials and energy;
- control and elimination of pollution;
- cutting manufacturing costs by increasing productivity through automation;
- the creation of more stable and rewarding new jobs;
- the creation of new industries and technologies.

Although new materials can be considered to be a "horizontal" subject par excellence, which affects a very wide spectrum of industrial sectors, it has developed in a rather piecemeal fashion under the wing of the major technological sectors of which aerospace, nuclear power, and more recently, telematics can be cited among the most important. This de facto situation is responsible for a certain multi-track level of development where a number of industrial sectors have made definite leaps forward, while others are lagging badly behind. However, the emergence of advanced materials as a fact of life was noted years ago and it has taken tangible form, in its own right, as the new branches of study of materials science and materials engineering. This awareness of materials has taken hold in Europe much more slowly than in the United States and Japan, where the top universities have already set up departments of materials science and engineering combining the activities of metallurgy, chemistry, ceramics and polymer sciences in one coherent entity. Advanced material applications inevitably require a multi-disciplinary approach. The complexity of the problems to be resolved requires cooperation between research workers in widely differing areas (metallurgists, chemists, solid state physicists, crystallographers, ceramicists, etc.). This cross fertilization between

scientific disciplines also makes materials R&D truly transnational in nature. Gaps have been pinpointed within the Member States, who are not themselves covering the entire range of new materials. Very often work in one Member State is complemented by that in another in such a way as to provide an ideal breeding ground for a Community programme.

Advanced materials are becoming more and more diversified; this in turn requires a greater degree of specialization for certain practical applications. Moreover, advanced materials have more sophisticated structures, and this complicates their use. The lack of adequate advanced materials is often a brake on the development of certain lines of activity. Magnetohydrodynamics, fuel cells and high energy density batteries have not been developed as they should owing to a lack of high performance materials. In order to achieve a better balance in materials R&D the following complementary activities must also be encouraged and supported since they are just as important as the research itself:

- study of the market impact of new materials;
- standardization and calibration of new materials in order to allow industry to incorporate such materials in an orderly fashion;
- the technological transfer of research results to the production of industrial components. This presupposes a well organized information system so as to avoid any breakdown in communications between the research and engineering teams (provision of a data bank);
- specialized training and refresher courses for engineers and technicians;
- the organization and support of materials related conferences, symposia, seminars and workshops.

The main areas of the EURAM research programme are as follows:

#### Development of metallic materials

- Light aluminium, magnesium and titanium-based alloys;
- high-performance magnetic materials;
- electrical and electronic contact materials;
- materials for surface coatings and machine tool cutting equipment;
- thin walled castings.

#### Development of engineering ceramics

- Optimization of engineering ceramics;
- metal/ceramic interface;
- composite ceramics;
- high-temperature behaviour of engineering ceramics.

#### Development of composite materials

- Organic-matrix composites;
- metallic-matrix composites;
- ceramic-matrix composites.

IV. ACTIVITIES ON MATERIALS AT INTERNATIONAL LEVEL - CHALLENGE FROM THE UNITED STATES AND JAPAN

The major industrialized nations outside the EEC - in this case the United States and Japan - have long recognized the enormous potential for technological development offered by materials. They are systematically carrying out ambitious materials research and development with long term aims in view and have endowed such schemes with substantial financial support. These plans will bear fruit around 1990 and thus pose a real challenge to European industry now.

"High tech" materials in the USA

The United States have exercised and maintained their leadership in new materials innovation since the Second World War. The succession of high technologies such as nuclear energy (Manhattan project) and more recently the space project (Apollo) have made a massive contribution to this very real situation. Materials research funded by the military departments must also be mentioned as, despite its confidential nature, it generates a significant spin-off of information and know-how. The Federal Government spends, year in, year out, a billion dollars on materials research, including military appropriations. This is matched by private industry, probably to a level many times this figure.

The materials programmes are coordinated and managed through agencies such as NASA and the National Bureau of Standards (NBS) or through Ministries such as the DOE, DOC or DOD. In recent years a number of public and private laboratories have widened their scope to include materials research. It therefore comes as no surprise that the United States occupy a key position in all of the crucial areas: superconducting alloys, amorphous metals, composite materials, data processing materials, engineering ceramics, special polymers, etc. American industry is highly dynamic and has become actively involved in innovative materials by investing considerable amounts of manpower and equipment in them. New uses for such advanced materials are constantly being sought, the result being that technology transfer is virtually automatic. In order to make the most effective use of this concentrated attack on materials, the Federal Government has also set up a materials study and testing centre at the University of Berkeley endowed with state-of-the-art equipment.

It must be pointed out, however, that in contrast to their earlier liberal attitude, the United States are now placing very severe restrictions on the dissemination of knowledge. The extremely liberal attitude to information exchange which used to take place between American and European laboratories is now falling by the wayside.

The "Materials phenomena" in Japan

The development of advanced materials is one of the prime concerns of Japanese R&D. The materials programme had its rather modest beginnings about 15 years ago but is now constantly gaining in stature thanks to the systematic orchestration of all the creative forces available to the Ministry of Trade and Industry (MITI). By pinpointing a number of vital areas, and adopting a direct pragmatic approach to them, Japan has scored excellent results and now occupies the following positions in the world league:

- leading world producer of engineering ceramics for electronics and advanced engines;
- second biggest world producer of titanium (on an equal footing with the USA);
- second biggest world producer of electronic and data processing components;
- second biggest world producer of carbon fibres.

In 1981, the MITI recast its materials programme in order to support advanced technology in the growth industries of the 1990s. This ten-year programme has brought together specialists in both pure research from universities and technological research from industry under one roof, with an annual budget of about US\$ 300 million.

The programme is centred on advanced materials holding promise for the future: e.g. controlled crystallization of alloys, electrically conductive polymers, high quality crystalline polymers, semi-conductors, engineering ceramics.

The Japanese commitment to engineering ceramics (called "Fine Ceramics"<sup>1)</sup> or "High-Tech Ceramics" in Japan) warrants a special mention:

- according to observers the cooperation between government bodies, industry and the universities is remarkably well-coordinated by the MITI. It is even said that Japan is in the grips of a veritable "ceramics fever";
- more than 2 000 research workers and engineers have been assigned to engineering ceramics, about 1 000 of these on structural ceramics for engines;
- a trade association known as the "Japan Fine Ceramics Association" provides an umbrella for 170 different industrial companies pursuing the development of "High-Tech Ceramics".

All in all this in-depth, long-term activity devoted to systematic innovation in high reward areas will give Japanese industry an undoubted competitive advantage.

The European materials industry will have to organize itself quickly if it is to accept the medium-term challenge imposed by the Japanese industry.

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1) High Technology Ceramics in Japan  
NMAB 418  
National Academy Press - Washington DC 1984

## V. EUROPE'S VULNERABILITY AS REGARDS MATERIALS

In the past, Europe has traditionally spear-headed the innovation and use of conventional materials. Steel, cast iron, cement, aluminium, magnesium and synthetic rubber will forever be associated with the earlier days when European industry dominated world technology. Even today, there are still excellent materials laboratories in Europe, but their innovative capacity is on the decline. This failure to keep up in the field of advanced materials bears a certain similarity to what is happening in data processing. Europe's creative spirit is receding and here laboratories are losing ground to overseas competitors. Nothing better illustrates Europe's decline than the long list of basic "firsts" notched up by American or Japanese laboratories in the more recent past:

- RSR amorphous alloys,
- memory alloys,
- superplastic light alloys,
- new polymers,
- carbon and ceramic fibres,
- electrically conductive polymers,
- extremely pure fine ceramics,
- high-performance magnetic materials (Fe-Nd-B).

Most of these innovations will gradually form the core of new high-technology and value-added industries. They will help to create thousands of new jobs. In order to survive, Europe's industries will have to conclude licensing or cooperation arrangements, which could weaken their independence and increase their vulnerability still more. The direct or indirect results of this technological dependence on materials are also highlighted by the following facts:

- 4 out of every 5 patents in the materials field are applied for by American and Japanese companies;
- the European weakness lies in its low technological transfer rate from fundamental research to industrial application;
- it is estimated that Europe pays several hundred million dollars per year in royalties to the United States and Japan;
- the direct import of high technology components produced outside Europe reaches very considerable proportions. It is helping to upset the Community's balance of payments;
- it may also be assumed that thousands of jobs are lost in Europe every year as a result of this failure to compete.

In order to break this vicious circle of vulnerability and dependence and also to become competitive again on world markets, European industry must invest huge sums in the technological innovation of materials. By bringing together the materials industries of the EEC into one cohesive unit, the EURAM project will act as a catalyst for the promotion, at last, of a truly European materials engineering science.

## PROPOSED RESEARCH TOPICS UNDER THE EURAM PROGRAMME

### LIST OF MAIN R & D TOPICS

#### Metallic materials

- Topic 1 : Aluminium alloys
- Topic 2 : Magnesium alloys
- Topic 3 : Titanium alloys
- Topic 4 : Electrical contact materials
- Topic 5 : Magnetic materials
- Topic 6 : Coating and tooling materials
- Topic 7 : Thin-walled castings

#### Engineering ceramics

- Topic 8 : Optimization of engineering ceramics
- Topic 9 : Metal/ceramic interface
- Topic 10 : Composite ceramics
- Topic 11 : High-temperature behaviour of engineering ceramics

#### Composite materials

- Topic 12 : Organic composites
  - (a) Thermoplastic matrix
  - (b) Thermo-setting matrix
- Topic 13 : Composites with metallic matrix
- Topic 14 : Other advanced materials for specific applications

#### Choice of topics

The research topics listed above have been selected in the light of the experience acquired and the results obtained during the first programme on Substitution and Engineering Ceramics. New topics relating to light alloys and to composites have been added in order to meet the overriding needs of the high technology sectors of industry.

Some topics of the previous Substitution programme being well advanced, such as packaging materials, are no longer included, whilst others such as joining technologies (soldering and brazing or materials for electronics) find their place in other more appropriate EC programmes (e.g. BRITE and ESPRIT respectively). Topics involving engineering ceramics will be expanded considerably. Other topics, such as electrical contact materials or magnetic materials are again included but reorientated towards new applications.

Magnetic materials are of particular interest. Initially based on permanent magnets of the samarium-cobalt type, the new programme will concentrate on materials based on neodymium/iron/boron, which are much more efficient and economic.

These alloys, endowed with a very high coercivity, will create, in the medium term, a truly major technological change in the electrical motor industry. Their development and optimization must therefore be speeded up.

The new topics on alloys and composites are particularly appealing to the transport equipment industries and their component manufacturers. The technological challenge which they will have to meet in future will centre on the quality of their products and of the material used.

The research topics under the EURAM programme have been subdivided into three areas. These constitute the first cohesive entity, which should provide effective backing for Europe's advanced technology industries.

Research work on materials - is confronted with various fundamental, laboratory and production engineering aspects.

#### Fundamental aspects:

- theoretical considerations on materials structure, solidstate physics, crystallography, thermodynamics, kinetics, etc.

#### Laboratory experiments:

- product synthesis: chemical reactions, kinetics, reaction efficiency, product purity.
- product characterization: physical, chemical, mechanical tests;
- product testing procedures and data accumulation.

#### Materials production engineering:

- Pilot experiments in laboratory;
- conceptual design of more economical production processes;
- design methodology for high mechanical performance of the components, including life prediction, material failure criteria, reliability, defect tolerance.

Within the framework of EURAM the Commission intends, at a suitable time, to examine the possibility of presenting other activities in the field of Advanced Materials.

## DEVELOPMENT OF METALLIC MATERIALS

### Topic 1 - Aluminium alloys

Aluminium and its alloys are already well developed yet they still offer much potential for development - especially in transport (aerospace, automobile) where the ratio of mechanical properties/specific weight plays an essential role.

The development could follow these three lines:

#### 1.1 Further development of conventional aluminium alloys to achieve greater performance and reliability

- Improving the mechanical properties such as fatigue strength, fracture toughness, resistance to abrasion and weldability;
- improvement of purity of the basic alloy constituents;
- in-service safety and reliability should also be improved in order to reduce inspection, repair and maintenance costs;
- improvement of corrosion resistance by surface treatment;
- development of non-destructive testing methods (NDT) for Al alloys.

#### 1.2 Development of new powder-metallurgy aluminium alloys

- Systematic study of the powder metallurgy of various compositions of new alloys. The rapid solidification route will be used in all of its forms;
- further work on Al-Li alloy and its derivatives;
- targets to be aimed at: ultra-fine (micrometre sized) particles, temperature-hardening and stabilization of alloys by addition of insoluble dispersion hardeners;
- study and scaling up of powder shaping: compaction, moulding, sintering, extrusion, rolling, etc.

#### 1.3 Development of superplastic Al alloys

- Since superplasticity is obtained via ultra-fine grain structures, it will be useful to study ultra-fine Al powders by using the rapid solidification technique under an inert atmosphere;
- definition and characterization of new superplastic alloys, study of their practical application;
- study of the casting of components by the fluid-phase technique (rheocasting);
- investigation of relationship between high purity constituents and the mechanical alloy properties;

- improvement of joining properties (weldability and diffusion bonding) of Al alloys.

#### Topic 2 - Magnesium alloys

##### 2.1 Development of new Mg alloys having improved characteristics

- The aim here is to achieve a net improvement in the mechanical strength and chemical (corrosion) resistance of Mg alloys. The creep threshold would also have to be increased to 200°C;
- adaptation of new Mg alloys to modern casting techniques (rheocasting or thixo-casting);
- work on ultra-high purity Mg;
- upgrading of Mg alloys by controlled addition of hardening agents (e.g. ZrO<sub>2</sub>, TiO<sub>2</sub>);
- adaptation of the production engineering techniques for new Mg alloys (forging, extrusion, rolling, etc.).

##### 2.2 Improvements to magnesium alloys coatings

- Development of simple, effective methods of coating magnesium components which are compatible with semi-continuous and continuous production processes. Elimination of chromium salt treatment;
- development of coatings and surface treatment processes, and associated automated equipment;
- study on reducing the fire risk during magnesium component production;
- studies on thermal damage to Mg components (fire, heat).

##### 2.3 Development of a new range of rapid solidification (RSR) magnesium alloys

- Opening up of new applications for magnesium by the rapid solidification route and powder metallurgy. The products developed must be compatible with the mass production of components;
- improvement of shaping processes: pressing, casting, extrusion;
- improvements to product reliability and NDT methods;
- increase in the operating temperature threshold of magnesium components.

Topic 3 - Titanium alloys

3.1 Simplification of titanium alloy preparation via the direct reduction of mixed oxides:

- systematic study of the high-temperature calcium treatment of mixed oxides in order to obtain titanium alloy powder (parameters: kinetic temperature reactions, grain size distribution, product purity, variations in composition);
- study of suitable methods and scaling-up technology for the shaping of these alloy powders, (compacting, sintering, extrusion, rolling, etc.). Cost reduction.

3.2 Powder metallurgy and high-performance titanium alloys for transport applications

- Study of ways of producing titanium components at a lower cost using powder metallurgy and new high-performance titanium alloys;
- study of new more cost-effective titanium alloys containing oxide dispersants in order to improve their characteristics (dispersion hardening);
- development of rapid solidification routes for the production of titanium alloy powders.

3.3 Technology of semi-finished products and fabrication of titanium-alloy components

- Systematic examination of the fundamental aspects of forming titanium-alloy "semis". Both physical and metallurgical aspects should be taken into account;
- study of superplastic titanium alloy forming in order to produce near-net-shape components;
- study of methods of reducing the weight and cost of producing titanium alloy components without impairing their reliability;
- study of the physical strength and chemical resistance of titanium alloy components (maximum operating temperature, oxidation); work on stiffness improvement;
- systematic study of corrosion, and, in particular, sea-water corrosion, of titanium-alloy offshore equipment.

Topic 4 - Electrical and electronic contact materials

- Systematic study of new materials for use as electrical and electronic contacts to replace the metals normally used, such as silver, platinum, noble metals, etc.;
- development of new ways of treating the surfaces of electrical contact materials in order to protect these from erosion by electric arcing;

- development of new porous-structure materials (tungsten carbide) infiltrated with silver or copper alloys and the study of their electrical functions;
- development of new materials for electric components: condensators, carbon electrodes.

Topic 5 - Magnetic materials

- General and systematic study of new high performance magnetic materials in order to replace Co and Sm with more freely available and cost-effective metals;
- study and technology of magnetic alloy powder metallurgy and other fabrication processes belonging to the Fe-Nd-B family and other rare earth, iron rich compounds with the addition of other elements in order to optimize their magnetic characteristics;
- study and practical application of well characterized permanent-magnet components for specific industrial applications. Parameters for study: grain size distribution of powder, powder metallurgy, RSR, sintering, magnetization curves, direction and uniformity of magnetic field, component geometry, machinability, maximum service temperature, etc.;
- analysis of new permanent magnets from an economic and market-impact viewpoint.

Topic 6 - Materials for surface coatings for cutting and machining applications

- The overall aim of this R&D should be the development of new coatings, the improvement of technological processes and the replacement of strategic metals such as chromium and cobalt;
- development of new ceramic materials, (oxides, borides, nitrides, carbides) for surface coatings and their application technology;
- research, development and technology of new ceramic cutting materials for high-performance machining;
- development and optimization of surface treatments and coating methods (ion implantation, PVD, CVD, lasers, etc.);
- development of new steel alloys with high Si, Al and Ni contents.

Topic 7 - Development of improved thin-walled castings

- Improving the mechanical characteristics of spheroidal-graphite cast iron for thin-wall components (cast iron shells having improved rigidity and lower vibration levels for engines);

- development of casting techniques for thin-wall components (cast iron, aluminium alloys and other materials). Improvement of moulds with refractory linings for batch production;
- study of new cast alloy structures: grain fineness, segregation, micro-porosity.

#### DEVELOPMENT OF ENGINEERING CERAMICS

##### Topic 8 - Optimization of engineering ceramics for use in engines

- Development of advanced ceramics and their production technology using closely specified SiC,  $\text{Si}_4\text{N}_3$ ,  $\text{ZrO}_2$ , Si-Al-ON, etc. powders;
- study of ceramic powder characteristics as a function of component quality, reproducibility and reliability;
- design of the scaling up processes and automation of batch production methods for high-quality ceramics, (for example: in I.C. engines);
- research into new ways of compacting ceramic powders and quality control;
- optimization of the complex relationship between powder, pressure, temperature, density and mechanical quality.

##### Topic 9 - Study of metal/ceramic interface: cermets

- Systematic, comparative study of ceramics, metal or alloy expansion rates with their association in mind;
- research into adequate ceramic/metal bonds;
- production of cermets by powder metallurgy;
- conceptual and engineering studies relating to the mass production of components.

##### Topic 10 - Study of ceramic composites with fibres or whiskers as reinforcement for industrial applications

- General study and development of reinforced ceramic composites able to withstand very high stresses (mechanical shock, tensile stress, temperature variations);
- optimization of powders and fibres in line with their uses in IC engines and other applications;
- systematic study of methods of compacting high-density components. Optimization of the relationship between pressure/temperature/density/mechanical strength, powder composition, fibre structure and orientation;

- optimization of batch production costs for high-performance ceramic components; study of the relationship between the cost and mechanical properties of engine components.

Topic 11 - Basic study of the high-temperature behaviour of engineering ceramics

A study of the basic aspects of ceramic behaviour under the operating conditions inside an IC engine (adiabatic diesel). The effect of temperature will be a decisive factor. Experiments will be conducted at maximum temperatures in order to plot operating limits. The temperature will also be varied very widely in order to simulate engine acceleration states.

- Systematic study of all of the basic aspects of ceramic/ceramic friction and abrasion as a function of temperature (max. 1500°C);
- conceptual study of an effective, simple system of measuring high temperature ceramic friction;
- development of a solid or liquid high-temperature lubricant that can be incorporated into the ceramic;
- examination of suitable methods of treating ceramics in order to improve their friction coefficient;
- improvement of the oxidation and corrosion resistance of engineering ceramics, and particularly their resistance to combustion products or mineral salt used on roads (for example, gas turbines).

DEVELOPMENT OF COMPOSITE MATERIALS

Topic 12 - Organic-matrix composites

12.1 Optimization of thermoplastic organic-matrix composites and their stiffeners

- Study of the basic properties of ductile thermoplastic matrices (polyesters, polysulphides, etc.) in which advanced fibres such as carbon, aramids, ceramics, etc. are embedded. Development of a family of self-reinforcing products;
- widening the range of operating temperatures of this family of composite materials (250°C during steady-state conditions and 400°C during peak conditions);
- further development of hot forming and reaction injection moulding (RIM);
- improvement of mechanical and thermal properties of thermoplastic composites;
- basic study of matrix/fibre interface and of the structural characteristics of the composites.

#### 12.2 Development of thermosetting organic-matrix composites

- Systematic and basic study of the properties and matrix/fibre combinations of thermosetting composites (polyimides, epoxy, etc.);
- investigation of matrix/fibre interfaces as a function of temperature. Fibres to be studied: carbon, boron, aramids, ceramics, etc.);
- study of semi-finished products as a function of maximum permissible operating temperature;
- tests on hybrid composites - mixture of two types of fibre.

#### 12.3 Development of fabrication methods and technologies for organic composites

- Adaptation of organic composites to mass production methods (motor vehicle or aerospace);
- study of the physical and chemical parameters relating to the joining and assembly of heterogeneous composite materials;
- development and control of the production of larger, more sophisticated components;
- development of non-destructive testing methods for in-service monitoring purposes.

#### 12.4 Development of design methods for composite structures

- Provision of a methodology and design rules for organic-matrix composite structures;
- development of methods of analysing composite behaviour under mechanical stress;
- design and development of energy-absorbing composites;
- study of organic-matrix composite reliability, improvements to detection and fault identification techniques. Study of fault propagation mechanism in matrix and fibres.

### Topic 13 - Metallic-matrix composites

#### 13.1 Composites with an aluminium-alloy matrix

- Development of the basic constituents of these composites and optimization of their composition;
- substantial improvement of the physical, chemical and mechanical characteristics of these composites (modulus of elasticity, fatigue strength, increase in heat resistance threshold);

- systematic investigation of the following matrix/fibre interfaces: Al/B, Al/SiC, Al/Al<sub>2</sub>O<sub>3</sub>, Al/C, Al/Ti or Al/steel.

**13.2 Development of fabrication methods and technology of raw compounds using Al composites**

- Optimization of the quality/price factor;
- optimization of fibre size and alignment within the Al matrix as a function of the mechanical properties desired. Study of fabrication problems;
- development of quality control and non-destructive testing (NDT) methods.

**13.3 Composites with a magnesium alloy matrix**

- Development of a new generation of magnesium-matrix composite materials;
- study of the development of methods of producing semi-finished or raw components;
- study of the optimization of both the quality/price and density/strength ratios;
- improvements to the operating temperature threshold and to fire and corrosion resistance.

**Topic 14 - Other advanced materials for specific applications**

For obvious reasons the list of topics covering advanced materials given above cannot be considered as exhaustive since this field is widening all the time. Therefore some development work should also be devoted to specific borderline materials with an interesting industrial potential. These will be treated on a case by case basis.

The following research lines can be given as an indication:

- memory alloys;
- materials with high energy absorption;
- highly corrosion resistant marine materials for offshore structural applications;
- composite materials containing amorphous matrices;
- composite materials with glassy or vitreous matrices;
- composite materials with elastic matrices for energy absorption.

## Call for Proposals

Brussels OFFICIAL JOURNAL OF THE EUROPEAN COMMUNITIES Supplement in English  
19 Jun 86 p 1

[Text]

### RESEARCH ACTION PROGRAMME ON MATERIALS

(1986 to 1989)

#### Call for research proposals on advanced materials (EURAM)

The Commission of the European Communities is implementing a multi-annual research and development programme on advanced materials designated EURAM (European Research on Advanced Materials) with a total budget of 30 million ECU. (1)

The main objective of the programme is concerned with the development of advanced materials, upstream of the manufacturing industries, by combining basic research with engineering development. This means the creation, development and use of new materials and the upgrading of more conventional materials to a higher level of sophistication at competitive production costs.

The programme covers three main research areas:

1. *Metallic materials*

Aluminium, magnesium and titanium alloys. Magnetic alloys and electrical contact materials. Materials for surface coatings. Thin walled castings.

2. *Engineering ceramics*

Production techniques of high quality ceramic powders. Powder processing, reproducibility, reliability.

3. *Composite materials*

Development of organic, metallic, ceramic and amorphous matrix composites. Interfacial phenomena between matrices and fibres.

The programme will be carried out principally by means of cost-shared research contracts where the European Community contribution will in general be 50 % of the overall cost.

The Commission invites proposals for participation in the programme. The proposals will be treated in strictest confidence. They may be submitted by any natural or legal person, by public or private bodies, established within the territory of a Community Member State.

The duration of the contracts will not exceed 36 months. The deadline for the submission of proposals is 17. 10. 1986.

The proposals will be judged on their value to the Community, their scientific merit, their innovative approach, and their potential for industrial application.

Preference will be given to joint projects associating organizations of at least two Member States. Approximately 90 % of the funds for contracts will be allocated to projects which require a minimum annual European Community contribution of 80 000 ECU.

Please contact the Commission at the address below for a detailed description of objectives and research topics of the EURAM programme, and for proposal forms.

Address: Commission of the European Communities,  
200, rue de la Loi,  
B-1049 Brussels,  
DG XII/G — EURAM Programme.

Tel: (2) 235 70 62 (General information),  
(2) 235 52 90 (Technical information).

Telex: 21877 COMEU B.

Telecopy: (2) 235 01 45.

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(<sup>1</sup>) OJ No L 159, 14. 6. 1986. Council Decision 86/235/EEC of 10. 6. 1986.

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CSO: 3698/3

## WEST EUROPE/ADVANCED MATERIALS

### ADVANCED MATERIALS RESEARCH IN EURAM, BRITE PROJECTS

Paris COMPOSITES ET NOUVEAUX MATERIAUX in French Jun 86 p 1

[Unsigned article: "Conference on Advanced Materials and Fundamental Technologies"]

[Text] On 2 June 1986, the National Association for Technological Research (ANRT) organized an informational conference on the EURAM and BRITE research programs, each of whose application framework aims to support the EEC in research and development activities. This support is far from negligible, amounting as it does to 40-50 billion ECU per year for the EEC, one-fifth of which is expected to come from France if the projects are approved.

#### EURAM 1 (European Research for Advanced Materials)

Presented by Mr Wurm, of the EEC's DG XII, this program addresses itself primarily to fundamental research, listing composite materials in the following topics:

- Topic 10 Composite ceramics
- Topic 12 Organic composite materials
  - a) Thermoplastic matrix
  - b) Thermohardening matrix
- Topic 13 Metal matrix composite materials
- Topic 14 Other advanced materials for specific applications

The call for bids should be published by the commission before the end of June, with the files being turned over to the commission within four months.

Information can be obtained from the Commission des Communautes Europeenes (CCE), DG XII-G EURAM, 200 rue de la Loi, B-1049, Brussels, Belgium; telephone: 32-2-235.70.62 for general information, and 32-2-235.52.90 for technical information.

In France, contact Mr Houze, telephone 45.56.32.32 at the Ministry of Industry; Mr Escaig, telephone 46.34.31.70 at the Ministry for Research and Higher Education; and Mr Serge Antonioli, telephone 16 (1) 46.54.90.40 at CEA.

A EURAM II program should be launched in 1988.

**BRITE (Basic Research in Industrial Technology for Europe)**

Already familiar to French manufacturers, the second phase of this program was presented by Mr Van der Eijk, also from the CCE's DG XII. Aimed at precompetitive applied research, this program also includes among its topics polymers, composites, and other new advanced materials. Out of a total of 103, about a dozen projects of an essentially composite nature had been accepted for BRITE's first phase, launched in June 1985.

The files for the second phase should be available in June at the CCE, and a call for bids will be issued between December 1986 and January 1987.

Information can be obtained from CCE DG XII-BRITE, 200 rue de la Loi, B-1049, Brussels, Belgium; telephone: 32-2-235.59.60.

In France, contact Mlle F. Girault, telephone 47.04.47.57 at ANRT.

11,023  
CSO: 3698/667

WEST EUROPE/ADVANCED MATERIALS

JAPANESE CERAMIC TUBE COMPANY ESTABLISHED IN NORTHERN ITALY

Milan IL GIORNO in Italian 29 Aug 86 p 10

[Article by Roberto Bagnoli: "A Piece of Japan on the Banks of the Adda: Ceramic Coated Tubes Produced for Falck, Lucchini, and Italsider"]

[Excerpts] Milan -- 29 August. With a small group of only four people, and in their usual quiet manner, the Japanese have arrived in Lombardy. And thus, in Misano Gera d'Adda, a small town south of Bergamo, the Japanese have decided to set up the first Japanese industry in Lombardy. It is only the third of its kind in Italy, following Yoshida (zippers) and Honda (mechanical parts).

Shinto Italia is the distant European arm of the Shinto Industrial Company of Nagasaki, the largest producer in the world of iron pipes treated with a special refractory process. Shinto Italia was created on paper in November 1984, but only in the first few months of this year did it begin to produce its special iron pipes, which are the same as those produced in faraway Japan. It was Bergamo businessman Dante Signorelli who convinced Sunao Nishi, president of the Nagasaki company and inventor of the special ceramic covering process, to come to Europe. Dante Signorelli, 52, who already is the owner of the small Refrattari Misano firm (35 employees), has been for the past 10 years the most important Italian representative for the marketing of Shinto pipes.

The problem of coming to Europe began for Shinto in 1984 when a Japanese rival decided to construct a plant in Belgium and thus invade the European market. "Shinto's intention," Dante Signorelli says with pride, "was to settle in Germany, a country which seemed to them more reliable and to have fewer problems. I managed to change their minds. Of course, it was not easy. I alone know how many trips I made to Nagasaki, but in the end I succeeded."

Signorelli also succeeded in becoming a partner in Shinto Italia. The Japanese contributed their know-how and money (6 billion lire

in all). Signorelli contributed the business organization and the land on which the plant is located, 20 thousand square meters adjacent to the Refrattori Misano. The Nagasaki company owns 55 percent of the new firm and Signorelli 45 percent, in addition to being the exclusive sales agent for the pipes.

At present, there are about 20 Italian Shinto employees in Misano Gera d'Adda, as well as four Japanese, but the goal is to grow. "Under consideration," Signorelli says, "are other steel and automobile-industry related projects. We are satisfied for the moment to produce 70,000 pipes per year even if our potential production is 500,000." The Falck steel plants, the Luchini and Leali industries, and Italsider are all customers of Shinto and Refrattari Misano.

Sunao Nishi's invention is to apply "aluminum coating" to iron pipes (with different diameters but all with a uniform length of 5 and 1/2 meters) and then to treat them both on the inside and outside with a ceramic coating. "In this way," Alfredo Signorelli, Dante's 28-year old son, explains, "the pipe becomes 10 times harder and stronger than one made of processed steel. What are they used for? For blowing oxygen in electric furnaces."

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CSO: 3698/M254

WEST EUROPE/ADVANCED MATERIALS

BRIEFS

FRENCH ZIRCONIA POWDER FACTORY--Criceram, a Pechiney subsidiary specialized in the production of powders for high technology ceramics, will build in Jarrie, near Grenoble, a plant for extra-fine zirconia powders, with a capability of 80 tons per year. This new unit will be operational at the beginning of 1987. At the Jarrie location, Criceram is presently producing ultrapure (between 99.9 and 99.999 percent) alumina powders, as well as single crystal alumina synthetic sapphire, particularly for infrared optical applications. Criceram is a world leader in these two activities, and the company exports 80 percent of its production, mainly to the United States, Japan, and FRG. On this basis, Criceram develops new products such as Sialon and silicon nitride (for ceramics that will withstand high wear and heat), barium and strontium titanate, and aluminum nitride (for ceramics used in electronics). In strengthening its position as supplier of raw materials for high technology ceramics, Pechiney reinforces its aims in the new materials sector. Through its subsidiaries, Criceram, Ceramiques Techniques Desmarquest (structural and optical ceramics), Xeram (ceramics for electronics), Howmet Turbine Components Corp (ceramics for precision casting), and Carbone-Lorraine (carbon-carbon composites), Pechiney is currently achieving revenues of about 350 million francs in ceramics activities. [Unsigned article] [Text] [Paris COMPOSITES & NOUVEAUX MATERIAUX in French June 86 p 13] 11,023

UK NON-WOVEN CARBON FIBER PRODUCTS--The British specialist RK is getting ready to manufacture non-woven carbon fiber products consisting of bundles of 320,000 (320 k) fibers laid on an equally non-woven support, and bound by a 60 mm-long transversally-wound carbon fiber. The assembly appears as a felt whose density varies from 300 to 600 g/m<sup>2</sup>. The originality of the process consists in initially installing preoxidized fibers; final carbonization is carried out on the assembled product in an oven. The cloth is available in strips 500 mm wide. These non-woven products will be sold at about 200 F/kg. Its essential applications arise in the fabrication of tooling for composite materials molding. [Unsigned article] [Text] [Paris INDUSTRIE & TECHNIQUES in French 10 June 86 p 9] 11,023

CSO: 3698/677

WEST EUROPE/AEROSPACE

ESA SPACE POLICY SEEN EMERGING IN HOTOL, HERMES, SAENGER PLANS

Duesseldorf HANDELSBLATT in German 15-16 Aug 86, Special Section "Signatur der Zeit" p 1

[Article by Rolf H. Fricke: "Money Also Plays the Leading Role in Space"]

[Excerpt] The focus of France's efforts toward European and national independence (surely in that order) in space is the European Space Agency (ESA) which resides in Paris. It has eleven full members. France and the FRG are contributing just under half of the 1986 ESA budget (\$987 million) in nearly identical shares.

To the ESA's nearly \$1 milliard (billion) budget an additional \$700 million must be added which is paid directly by the national governments for space programs. Compared to the sum which the United States spends annually on programs and projects outside the earth's atmosphere (\$15 milliard (billion) on the average), these amounts still appear small. However, at the ESA meeting in Rome in January of last year the member nations abandoned the quaint ways they had followed for years. They agreed to increase the ESA budget by 70 percent by the early 1990's.

Heading the list of priorities for the majority of the ESA members is further development of the unmanned Version 5 Ariane rocket. This model, like its four predecessors an expendable rocket, is supposed to be able to lift larger payloads, i.e. satellites, into geostationary orbits. This project is the cause of scarcely any disagreement within the ESA. This is because the ESA's baby, "Arianespace," has been a very successful commercial operation to date and in terms of satellite deployment has taken a great deal of the market share away from NASA to become currently number one in the international market. In principle, nothing was changed either by the recent loss of an (insured) satellite worth DM 200 million when the launch at the Kourou Base in French Guyana had to be aborted due to failure of the third stage to ignite (the French firm SEP was responsible for this stage). For one thing, the Challenger accident at Cape Canaveral, in which seven people lost their lives, was a severe setback for Ariane's competitor; and for another, Arianespace with its unmanned system will surely be able to offer lower prices over the long term than can NASA with its (still) heavily state-supported, manned Challenger system for launching satellites. A total cost of \$2.6 milliard (billion) is estimated for the development of the Ariane 5.

In Rome, the ESA member nations also reached a fundamental agreement on the construction and development of the space lab "Columbus." This lab (total cost also \$2.6 milliard (billion)) is to be placed in a geostationary orbit. It is intended as a part of the manned U.S. space station which is to begin operation in the mid-1990's. Additional space labs for this space station are to be developed by the U.S. and Japan. But this project does not yet have the final green light. This decision is to be made in the fall. Only then can the initial funds be released.

There is still no agreement at all among the ESA member nations as to the purpose for which "Columbus" is ultimately to be built. France and to a certain extent the FRG favor a lab design which will permit the space lab to be used as the "nucleus" of a subsequent manned European space station. Understandably, this view meets with little approval in the United States; this would not be in the spirit of international cooperation, they say. The question remains whether Europe will be in a position to work with the United States in a space station to the benefit of all while competing with it in other areas. With regard to "Columbus" and its financing, as well as questions of patents and legal rights, some hard negotiating still lies ahead.

The "favorite" of the French space planners, however, is the "Hermes" project, a manned space glider (substantially smaller than the U.S. shuttle Challenger) which will ride into space more or less "piggy-back" on an Ariane 5 rocket and from there push out farther into space. As the French see it, Hermes will ferry men and materials to the space station. This is where it becomes clear why France sees "Columbus" as part of a European space center rather the U.S. space station--due to the link between Hermes and Columbus. The French currently estimate a total cost of about \$2 milliard (billion) for Hermes. However, the experts do not deny that the project when completed could cost about twice that much. The government of the FRG will deliver its final opinion on Hermes in the fall of this year. Although Chancellor Helmut Kohl has already given French President Francois Mitterrand non-binding verbal assurances, it is no secret that Hermes also has detractors in Bonn. Some of those responsible for the decision favor closer cooperation with the United States; others find the entire space program too expensive in the long run. How difficult the situation is, is evidenced by the fact that a high official considered one of the strongest Hermes' advocates in all of Europe was abruptly forced into retirement by FRG Minister of Research Riesenhuber.

Finally, there is still the British "Hotol" project (horizontal take-off and landing) for which London is trying to get support. According to Great Britain's plans, Hotol is to be a single-stage space plane which could operate in the atmosphere as well as in space using a new kind of engine. Hotol has relatively little chance of being realized within the ESA for the simple reason that the project is likely to be considerably more expensive than Hermes.

There is also a purely German space project. The plans for "Saenger," developed by the German Research and Development Institute for Air and Space Travel (DFVLR) and employees at Messerschmitt-Boelkow-Blohm, were presented by the Minister of Research. The project is named after Eugen Saenger, the German space pioneer who died in 1964. "Saenger" comprises an airplane and a space

plane and is designed to be another kind of piggy-back system in which a four-jet airplane (about the size of an Airbus) takes the smaller space plane to an altitude of about 30,000 meters; from there it climbs into orbit using its own rocket engine. Saenger, too (if realized, it will likely be more expensive than Hermes), can be used as a transport shuttle to and from space stations (room for 12 passengers) or for placing satellites in orbit.

Only the rough outlines of a common European space policy exist--Arianespace alone (a majority holding of the French) has been successfully realized to date for placing satellites into geostationary orbit on a commercial basis. If European dreams are to come true, many different components must come together: The political desire must be there. There must be an exchange of high technology without nationalistic reservations. And for reasons of cost efficiency and the exchange of expertise, Europe must not shy away from working together with the United States, with its long years of space-related experience, in those areas where both sides can benefit, such as with the space station, for example. On the other hand, Europe will have to take care that the money demanded by the Americans of their "paying customer" represents a reasonable expenditure in terms of the desired benefits. The past has shown that this danger exists.

In the final analysis, however, it is probably all a question of money. All of the European countries, even the big four, are by themselves too small to be able to finance ambitious space projects. It would probably be in the interest of all of them to concentrate their resources initially on a few projects which promise to be successful and which have financial backing and to continue from there step by step. Europe should not make the mistake of trying to do in 10 years what it took the United States more than 30 years to do.

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CSO: 3698/649

WEST EUROPE/AEROSPACE

BRIEFS

CNET-CNES HERMES COLLABORATION--CNES [National Center for Space Studies] has asked CNET [National Center for Telecommunications Studies] for assistance in the areas of speech compression and protocol evaluation on the European Hermes project to develop a spacecraft scheduled for launch in 1995. The first step in this assistance will be a critical inventory of speech coding algorithms with speeds of less than 5 kbits/s and around 32kbits/s, with their respective constraints. Plans also call for 1. demonstration of restoration and 2. evaluation of the performance of the protocols used: behavior of command procedures, study of their suitability for speech transport, and frame organization. [Text] [Paris REVUE FRANCAISE DES TELECOMMUNICATIONS in French July 86 p 10]  
13014/12781

ARIANE THIRD-STAGE HM-7 MOTOR TESTED--Paris--Around 40 tests of the Ariane rocket's third stage HM-7 engine are scheduled to take place at the SEP's [European propellant Co.] PF-41 launch pad in Veron [Eure Department, France] over the next three months, according to reliable sources. The purpose of these tests is to tune the engine, verify the changes needed, and ensure the success of three of its copies. SEP, CNES [National Center for Space Studies], ESA, and Arianespace all feel that this speed is necessary if the Arianes are to go back into active service during the first quarter of next year. This test campaign, which was recommended by a committee of inquiry appointed after the launch failure 31 May, already began on 2 August with a test of the engine's tuning with its old ignitor, which was the cause of the fourth Ariane failure two months ago. This 60-second test was carried out under ideal conditions and proved "nominal," i.e., exactly what the specialists expected. A second, identical test is scheduled for 7 or 8 August. These two tests are part of a series of so-called reference tests designed to verify the entire engine (or engines) to be used and to qualify the bench and the measurement instruments that have been installed, especially the high-speed camera for real time viewing of the tests. During the second phrase of the campaign, changes will be made in various engine parameters, especially the ignitor, in order to choose which of the models developed should be retained or to know exactly what a new one should be like. Later, the third phase will involve validating the changes made for two or three of these HM-7 engines. The new ignitor is not expected to be tested before late August. [Text] [Paris AFP SCIENCES in French 10 Jul 86 p 12] 13014/12781

FRENCH SPACE TECHNOLOGY FIRM--Paris--On 8 July, CNES [National Center for Space Studies], together with several banking firms and ANVAR [National Association for the Impelmentation of Research], signed a charter creating the Novespace company whose purpose it will be to implement space technologies in non-space industrial sectors and to promote the future industrial and commercial use of space. The Novespace corporation is headquartered at 15 rue des Halles, Paris, and is capitalized at 5 million francs, divided among CNES [National Center for Space Studies] (48 percent); a bank pool (48 percent), made up of Societe Generale (11 percent), BNP (10.5 percent), Credit Lyonnais (10.5 percent), Paribas (4.5 percent), Indosuez (4.5 percent), Compagnie Financiere (3.5 percent), Credit Chimique (2 percent), and Banque Courtois (1.5 percent); and ANVAR (4 percent). The first meeting of the Novespace board of directors appointed Mr Jean Pierre Fouquet (aged 40) chairman of the board. After serving as CNES director of operations in Guyana and manager of ground capabilities at CNES headquarters, Mr Fouquet was scientific attache in charge of space affairs at the French embassy in Washington from 1980 to 1983, before becoming ballistic and space systems division assistant manager in charge of new products and implementation of technologies at Aeroespatiale, where he has been for the past three years. Novespace offers both space and non-space sector clients a service and consultation package directly related to the application and commercialization of technologies. Its goal is to help bring space sector and other industries together for technology transfer and the granting of license. [Text] [Paris AFP SCIENCES in French 10 Jul 86 p 12] 13014/12781

SWEDISH-FINNISH-USSR VENTURE ON PHOBOS--Swedish instruments will do research on the magnetosphere of the planet Mars and analyze the surface of its Phobos moon. The equipment which consists of massspectrometers and has been built at Kiruna will reach Mars aboard two Soviet space probes, "So far this is our most ambitious space venture," Prof Bengt Hultqvist from Kiruna Geophysical Institute tells us. It is a true exploration trip to Mars. The first specimen of this massspectrometer is delivered to the Soviet Union on 10 September. The specimen to be mounted aboard the space probe will be delivered from Kiruna in the beginning of 1987. The launch to Mars and Phobos will start in the summer of 1988. A couple of Finnish research teams have joined the Kiruna project, which is totally responsible for the design and construction of the equipment. The Kiruna geophysicists are primarily interested in the magnetosphere around our neighboring planet Mars. The massspectrometer will measure the solar wind energy and the mass distribution as well as determine what kinds of particles occur there. The Soviet space planes will make it possible to let a probe sweep around the Phobos moon from the height of only ca. 50 meters above the surface. This can be accomplished quite easily since the moon is small and thus has a weak gravitational force. During a "low sniffing" across the surface of the moon a laser beam will be shooting towards the surface, flinging up moon dust--or, more exactly put--ions from the ground material. The mass of these ions will then be measured with the Swedish spectrometer package. An ion beam of xenon of rather high energy will also be shot towards the surface of Phobos. It will loosen up ("sputter") surface material, which similarly will be analyzed with the massspectrometer flying in space. [Text] [Stockholm NY TEKNIK in Swedish 11 Sep 86 p 36] /9274

CSO: 3698/1

WEST EUROPE/AUTOMOBILE INDUSTRY

EUREKA PROJECT 'PROMETHEUS' SEEKS COMPUTER-AIDED AUTO WITH AI

Rijswijk PT/AKTUEEL in Dutch 13 Aug 86 p 7

[Article by Bart Stam: "Prometheus To Create Safe, Intelligent Auto for the 1990's"; first paragraph is PT/AKTUEEL introduction]

[Text] In Greek mythology Prometheus is the great benefactor of mankind who brought the wrath of Zeus upon himself by bringing fire from heaven to the earth. Inspired by this myth, 13 European automobile manufacturers have put their heads together to jointly develop a safe, computer-managed auto for the year 2000. As a benefactor of mankind. Just over a month ago this project attracted a great deal of attention during its presentation at the third Eureka conference in London, where without any particular problem it won the much-desired stamp of approval from the 18 European delegations. Despite the scarcity of information about the project, which is still in its initial phase, PT/AKTUEEL lays out the facts.

The chairman of the board of the West German automobile company Daimler Benz, Dr. Werner Breitschwerdt, says that in the year 2000 the automobile will not differ in its essentials from the personal automobile of 1986. The automobile will still be the most used means of transportation and will only have been improved somewhat in aerodynamics, safety, and fuel consumption. That is the Daimler Benz boss's opinion. A very different view comes from Dr. Ing. Ferdinand Panik, who works in Daimler Benz's research section. During the Eureka conference in London he led the presentation and the discussion. Panik expects Prometheus to produce a totally new situation in the personal automobile industry. The futuristic automobile will no longer be a means of transportation alone; rather it will use modern telematics--the combination of telecommunications and data processing--to keep in constant contact with other vehicles on the road, the police, road service patrols, and aid services. At the same time, the driver of the future will be able to expect a broad range of information, thanks to computer systems. This is because Prometheus will consist of three subsystems: an information system for the automobile itself in which compact disks and expert systems will probably play a large role, an automobile-automobile communications system, and a network between the automobile and its surroundings.

## Steering Group

Who is hidden behind the acronym Prometheus, PROgraMme for a European Traffic with Highest Efficiency and Unprecedented Safety? Not just any companies, as we see from the following list: Matra, Peugeot, and Renault (France); BMW, Daimler Benz, Porsche, and Volkswagen (West Germany); British Leyland and Rolls Royce (Great Britain); Alfa-Romeo and Fiat (Italy); Saab-Scania and Volvo (Sweden). These automobile firms, which together form the project's steering group, have received a total budget of 83.4 million ECU's (roughly 200 million guilders). This sum is spread out over two phases. In the first year of the project, the start-up phase, 9.7 million ECU's will be made available for industrial research and 8.7 million for basic research. The second phase, which allows 7 years to develop a prototype, has a budget of 38 million ECU's. The sum will be invested to a large extent in industrial production of subsystems, spread out over the automobile and electronics industries. Seventeen million ECU's are available for so-called "institutional" research.

## Subcomponents

Eureka's Prometheus project thus consists of both basic and industrial research. The latter category includes the subsystems pro-car, pro-net, and pro-road. Pro-car is the computer system that will provide the driver with necessary information in the blink of an eye. Pro-net is the automobile-automobile communications system, and pro-road stands for the link between the automobile and its surroundings.

In basic research, the emphasis is on pro-art (methods and systems in artificial intelligence), pro-chip (custom hardware for intelligent processing in vehicles), pro-com (methods and standards for telecommunications), and pro-gen (a scenario to implement new systems).

Looking at the various country's contributions, we see that in basic research the French are concentrating on pro-art; the West Germans are taking the lead on pro-chip; the Italians are in charge of pro-com; and the British are responsible for pro-gen.

Of course, the question is how automobile firms that in many cases compete with one another are going to cooperate. According to Dr. Panik of Daimler Benz, sound agreements will have to be made on this point in the first year. He is confident that in West Germany, with support from the Federal Ministry for Research and Technology, the companies are prepared to exchange expertise and research without directly surrendering all the secrets of their own development departments. Of course, he says, it is very important that the subsystems like pro-car and pro-chip be compatible. Otherwise Panik says there is the danger that national interests will prevent Prometheus from providing a European standard.

## Safe Driving

As Panik had already noted during the presentation in London, the most important aim of Prometheus is to improve traffic safety. According to the

Daimler Benz executive, in its optimal phase the system would be able to correct to a considerable extent for human failings on the road such as poor vision, slow reactions, inexperience, and driving mistakes. "That's why," Panik says, "we have to put a system into the automobile that can use computers and telecommunications to facilitate certain activities. The system should give the driver the exact information he needs at the right time to make driving safe."

He says it is important to adapt microelectronics, data processing, sensors, and control systems to use artificial intelligence. Consequently it is necessary for governments and research institutes to work closely with the European automobile industry.

Daimler Benz's own computer simulations in West Berlin lead Dr. Ing. Panik to believe that Prometheus can lead to very safe driving. These show that at dangerous crossroads the number of accidents can be reduced by half if drivers get the information they need half a second earlier. The gain of a second produces a reduction of 94 percent. Similar percentages also hold for heavy traffic in thick fog, where a gain of 0.5 seconds reduces the number of automobiles involved in a chain reaction collision by half. As for passing, if the driver knows half a second sooner that somebody is coming in the opposite direction, then the number of head-on collisions can be reduced by 35 percent.

#### Fuel Savings

Improved safety is not the only argument that Prometheus's supporters advance. Major fuel savings should be possible too. Not just because an automobile-automobile communications system can reduce the number of forced stops and accelerations, which will make the automobile operate more economically. But also because the computer sees to it that drivers always choose the shortest route, since the system is equipped with all necessary information about the route. Driving about unnecessarily will be a thing of the past. Furthermore, the system indicates where there are detours, railroad crossings, bridges, and other obstacles. It is even possible to find out if a certain parking lot is full or not.

Ferdinand Panik says that Prometheus will make cars operate not only more economically but also cleaner. The output of nitrogen oxides will be reduced considerably. Adding a catalytic converter will only improve that even more, according to the West German. Moreover, driving will be more attractive, since despite the room it takes up, the computer will take over much of the driver's work.

Despite the high expectations of the participating automobile firms, Dr. Ing. Panik says Prometheus is not intended to create an entirely computer-steered automobile: "We're convinced that artificial intelligence will never totally replace the human mind, which is irreplaceable in such a complex operation as present-day driving," says the Daimler Benz executive.

## The Netherlands

For the present our country is less involved in this project, although the product development division of Volvo Car BV in the Netherlands will be keeping in contact with the parent company in Goteborg about Prometheus. It is also true that Philips and the French firms RNUR, SAGEM, and TDF launched their Carminat Project during Eureka III, and that it too was approved. This, however, is for an information system exclusively for goods transport. The goal of Carmat [sic] is to develop a two-way system capable of receiving and transmitting information for freight traffic in Europe. Both Philips and its French partners are basing their work on projects from the 1980-85 period. Philips will in all probability contribute its expertise from the CARIN Project. CARIN stands for CAR Information and Navigation, which Philips developed in its Natural Sciences Laboratory and Consumer Electronics Product Division. CARIN is a route-descriptive system based on the compact disk. The French are contributing to Carminat with the Atlas and Minerva Systems.

## Melding

It is no exaggeration to view Prometheus as a West German project, one that can count on full support from the Federal Ministry for Research and Technology: DM 10 million in the start-up phase and DM 32 million later. Five of the six forum members in London came from Daimler Benz, Volkswagen, Porsche, and BMW. A representative from British Leyland gave the sextet the requisite international character for Eureka. Still, the West Germans are not completely satisfied with the situation; they would like to talk with Philips and its French partners about melding Prometheus and Carminat. These talks would take place after the summer vacations. The question is, however, whether this can be done without a great fight: according to the scenario, when the start-up phase of Prometheus is over in a year, the electronics firms are supposed to be brought in. It is not inconceivable that the West German firms and the Federal Ministry will prefer to involve Siemens, AEG (which now owns a majority interest in Daimler Benz), Siemens [sic], or Blaupunkt in the project rather than a "stranger" like Philips. The coming months will show to what extent the people in Eindhoven can withstand the pressure from the East.

12593

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WEST EUROPE/BIOTECHNOLOGY

FINNISH SUCCESS IN GENE TRANSFERS, APPLICATIONS FOR PLANTS

Helsinki UUSI GUOMI in Finnish 20 Aug 86 p 9

[Article by Tapani Vaananen]

[Text] The Kemira research team has succeeded in making the first plant gene transfer in Finland that seems headed toward practical applications. Another participant in the research has been the genetics institute of the University of Helsinki under the leadership of Teemu Teeri. During the research, a segment of a DNA chain was transferred to an experimental plant and thereby a resistance to a certain antibiotic was created in the plant.

"We have been experimenting for about four years. The successful gene transfer went according to schedule. At the end of our current series of tests, our intention is to begin transferring various beneficial characteristics to cultivated plants," says the leader of the research team, Heikki Rosenqvist.

"Kemira's reason for forming the research team is to develop ever better plant strains particularly for Finnish agriculture," says Rosenqvist.

Gene technology research is at this time furthest advanced in the USA where plant strains improved by genetics technology are already undergoing extensive field testing programs. The first plants improved by genetics technology are expected to reach the market in the near future.

"We have worked with the American Calgene Concern. Kemira owns ten percent of Calgene's stocks. Calgene has conveyed the latest American technology to Finland," relates Rosenqvist.

The experimental plant used in Finland has been the tobacco plant, although the purpose is, by no means, to improve it. From now on the turnip rape will be the plant used in experiments.

"Experiments have already been conducted at Calgene laboratories. The main purpose is to improve the turnip rape's tolerance to pesticides. At the present time hardly a substance exists that can be used to control turnip rape pests, since the plant itself is killed by almost all toxins," says Rosenqvist.

Gene technology can be used to improve a plant's tolerance of cold and drought as well as its resistance to various diseases and destructive insects. Genetic improvements can be used to develop plant strains that are more productive than existing ones. In principle, gene transfers can be used to develop all kinds of plants, even new species.

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WEST EUROPE/CIVIL AVIATION

MILITARY AIRBUS A320 ON MBB DRAWING BOARD

Drawings Presumably from CSU Center

Munich SUEDDEUTSCHE ZEITUNG in German 10 Jul 86 p 2

[Article by sza: "Sketches for Military Airbus Presumably from CSU Center"]

[Text] Bonn--On Wednesday, Karl-Heinz Hansen, former SPD member of the Bundestag and current spokesman of the "Peace List" presented design drawings for a military version of the Airbus A 320 in Bonn, about which the TV magazine "Monitor" had reported on Tuesday. Hansen stated that the documents came from the CSU central office, and he pointed out that CSU-chairman Franz Josef Strauss is chairman of the board of directors of Airbus. The Greens announced that they would submit a written question in the Bundestag regarding the "militarization of the Airbus" for which DM4.5 billion in tax money has been spent so far.

A spokesman of the German Airbus, Director for Marketing and Strategy Hans Bernhard Birke confirmed in a radio interview that the company had looked into an airbus version for naval reconnaissance and submarine tracking at its own expense. This concept by MBB which is involved in the Airbus construction was examined by the German Navy, it was, however, rejected because of the high cost and insufficient suitability of the airplane. This had already become public in November of last year. Birke admitted, however, that the Airbus industry would be pleased if it were possible to develop a military version for naval reconnaissance or as a refuelling plane. (Commentary on page 4.)

Military Airbus Remains on Drawing Board

Munich SUEDDEUTSCHE ZEITUNG in German 10 Jul 86 p 4

[Article by sza: "Military Airbus Still on Drawing Board"]

[Text] Martin Gruener, undersecretary in the Ministry of Economic Affairs in Bonn and Federal Government coordinator for aviation matters was poorly informed when he denied in the TV program "Monitor" on Tuesday that there are plans for a military version of the passenger plane Airbus A320. It is true that one of Gruener's subordinates knew about the concept by the German Airbus

partner MBB for an airbus version for naval reconnaissance and submarine tracking as early as November of last year. He did, however, not inform his boss about it since the German Navy and MBB realized already then that the project would not go beyond a few sketchy drawings. At a conference in Bonn journalists and experts from government and industry were informed to that effect. The event did not cause any further sensation and did not come to Gruener's attention.

By the late nineties the German Navy wants to replace 18 propeller planes of the French-German type Breguet Atlantic which are used for remote reconnaissance and submarine tracking and as electronic listening posts. DM2.5 million are planned for this purpose and various airplanes were studied. The airbus version would be about three times as expensive as other planes and, in addition, it would not be maneuverable enough for submarine tracking where planes fly narrow loops at an altitude of only 15m above sea level even in bad weather.

Two propeller planes offer an alternative: The French Atlantic-successor ATL-2 and the American Orion which is derived from the passenger plane Lockheed Elektra. Both East and West have reconnaissance planes and bombers which are derived from civilian aircraft. From the perspective of a company which builds airplanes it is certainly legitimate to monitor the military market as well. However, in order to keep the budget straight Bonn has to make quite sure that the company does not divert into military developments tax funds which it gets as a subsidy for the construction of civilian aircraft.

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WEST EUROPE/CIVIL AVIATION

DOUBT CAST ON UK COMMITMENT TO NEW AIRBUS MODELS

Said to Favor MD11

Duesseldorf HANDELSBLATT in German 1 Sep 86 p 1

[Unattributed article: "The British Favor the MD11"]

[Text] London--At the British air show in Farnborough the top managers of airlines and producers were jolted by reports that the Thatcher government wants to cut in half the British subsidies of approximately DM2.1 billion for the development of the four-jet long-range Airbus A 340 and the twin-jet short-and medium-range plane A 330. While British newspaper reports to that effect were immediately denied by British Aerospace and the Industry Ministry, it is known that London would prefer a cooperation with the U.S. company McDonnell Douglas to having the Airbus consortium go it alone. To replace its three-jet DC-10 which is no longer competitive MacDonnell plans a new "MD 11" for 300 passengers which--together with the Europeans--is believed to have a chance against the Boeing Jumbo.

FRG Ready to Take Over

Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 30 Aug 86 p 11

[Article by J.H.: "England Against New Airbus Models?--Is Said to Have Denied Subsidies--Costs of \$2.6 billion"]

[Text] Frankfurt--In the development of the new airbus models A330 and A340 there seem to be problems with spreading the cost of \$2.6 billion among the members of the European consortium as usual. According to British newspaper reports British Aerospace wants to withdraw since the British government rejected a request for subsidies amounting to more than 700 million pounds for the development of the wings and favored a cooperation with McDonnell-Douglas instead. Shortly afterwards these reports were denied to news agencies; the word in London was that no applications for subsidies had been submitted yet and consequently there was nothing to indicate a refusal.

According to data by the Federal Ministry for Economic Affairs the financing of the development costs has not been decided yet in any of the countries involved. The profitability of the models which are planned for the nineties

has not been shown yet, and no orders had been received. However, government representatives of the countries involved will discuss the future of the airbus projects at the air show in Farnborough in Britain. Mrs. Thatcher stated recently that she did not want to see the development of "another Concorde" and demanded a stronger participation of the aviation industry (more than 50 percent of development costs). The tendency of the airbus developers to shift business risks to the government was also criticized, for instance, by the Economic Research Institute HWWA in Hamburg in connection with the A330 and A340 models. In the past, the federal government granted subsidies amounting to approximately 85% of new developments costs.

The financing problems of the British partner are well known in the Airbus consortium. German companies are said to be ready to possibly assume the commitments of British Aerospace. The planned models are a four-jet, large-capacity plane for about 300 passengers (A340), and a short- and medium-range twin-jet plane, for which Airbus hopes to obtain a 24 percent market share. The A340 model is expected to bring in orders amounting to \$24 billion for 300 planes. It must be able to stand up to the competition from the MD-11 planned by McDonnell Douglas, a further development of the DC-10.

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FOKKER IN INTERNATIONAL PROPFAN AIRCRAFT STUDY

Rotterdam NRC HANDELSBLAD in Dutch 26 Aug 86 p 9

[Article by one of our staff writers: "Fokker Participating in Propfan Aircraft Study"]

[Text] Rotterdam, 26 Aug--Along with the American aircraft company Boeing, the West German firm Messerschmidt Bolkow Blohm (MBB), and the Indonesian aircraft builder IPTN, Fokker is taking part in a preliminary study for the design and large-scale production of a so-called propfan aircraft with around 90 seats.

Indonesian Minister of Science and Technology Yusuf Habibie, who is also president of IPTN, revealed this. At first Fokker was unwilling to confirm the report, because it wanted to make it known during the upcoming Farnborough aviation show in Britain. Later the company spokesman admitted that Fokker is taking part in the project. According to the company, this is just a preliminary study. The project is still in the start-up phase. The contract will be signed shortly.

Total development costs for the planned propfan aircraft will be 3-4 billion guilders, according to Fokker Spokesman G. Knook. The main advantage of a "propfan" or "unducted fan" (propeller engines aimed backwards and pushing the plane rather than pulling it) is the considerable fuel savings it makes possible. Experts predict that savings of 15-30 percent will be possible.

The aircraft is temporarily being called ATRE-90 (Advanced Technology Regional Airliner); it will have 80-110 seats and is expected to be on the market in the mid-1990's. That means it will be ready a few years later than the Boeing 7J7, the first modern propfan aircraft, now being developed by Boeing and General Electric (engines). The 7J7 has 150 seats and is to be ready for sale in 1992. Boeing says that the first prototype test flights have been successful. Fokker has also been invited to participate in this project but has still not decided on that.

If successful, the ATRE-90 will compete with Fokker's own F-100, which targets the same market segment. The first deliveries of that aircraft start next year, however. The propfan aircraft will not be available until 8-10 years later.

Short, the Northern Ireland aircraft company, has received a credit of 30 million pounds from the European Investment Bank to invest in the F-100 project. Short is building the wing for the F-100. MBB too is working with Fokker on this project.

WEST EUROPE/FACTORY AUTOMATION

WARTSILA BUYS FINNISH, U.S. ROBOTICS COMPANIES

Helsinki HELSINGIN SANOMAT in Finnish 29 Aug 86 p 33

[Article by Juhani Pekkala]

[Text] Wartsila is buying Rosenlew Automation and the American GCA Industrial Systems Group. Preliminary agreements have been made on the transactions and finalization awaits approval by the authorities.

The turnover of the Rosenlew factory is about 50 million Fmks, and it employs 180 people. These Rosenlew employees will be transferred as old employees into the service of Wartsila.

GCA's turnover is 150 million Fmks. and it employs 300 people, all of whom will be transferred into Wartsila's service.

The activity of the purchased enterprises is concentrated on "the automation of manufacturing processes for specialized industrial plants." Automation in industry is an entirely new commercial venture for Wartsila.

Wartsila's reason for making the purchase is that the speciality area of the acquired enterprises are the so called portal robots, that is, the overhead lift type application of robotics, which is the fastest growing field of industrial robotics.

According to American information, the annual growth in this field is 20% with worldwide sales of about \$23 billion. By the beginning of the next decade, sales should swell to about \$80 billion.

Rosenlew, Wartsila and Kemppi Inc. of Lahti have collaborated to develop a robot for welding large blocks that is now being used on a trial basis at the Helsinki shipyards of Wartsila.

According to the executive deputy manager of Rosenlew, Tapio Vartiovaara, there were other prospective buyers but the collaboration of Rosenlew and Wartsila in developing shipwelding robots laid the foundations for the deal.

Rosenlew Automation, which is located in Ulvila, is recognized especially as a manufacturer of the robots and seeing-eye systems used in the production of

color cathode ray tubes. The otherwise ill-fated Valco cathode ray tube factory, for which Rosenlew produced the robots, was a stroke of fortune for Rosenlew's robot production. The cathrode ray tubes were lemons but customers noted that the robots operated faultlessly.

The only Rosenlew Automation product known by the great consuming public is a color tinting machine used by paint dealers to mix paints in order to obtain the exact tint desired by a customer.

GCA Industrial Systems Group, according to Wartsila, is the leading producer of portal robots. The robots are used in the aeronautical, automotive, semiconductor and heavy machine shop sectors of industry. GCA's share of the American markets is 50%.

GCA is also known as a significant developer of robot systems and control systems for automated production cells.

Wartsila reassured questioners that the focus of it's new activity will not be moved to the U.S. At least, their goal is to "combine Finnish applications know-how with American research and product development."

GCA's production plants are located in Minneapolis and it also has offices in Chicago and Detroit.

Rosenlew considers the sale to be "part of the long range plan for altering the structure of the concern". According to executive deputy manager Tatio Vartiovaara, the corporation will henceforth focus it's activity on the fields of packaging and the threshing combine industry which are in a "dynamic phase."

Rosenlew will invest the money its receives from the sale into these departments. They are characterized as primary areas of concentration for the corporation which is presently attempting to acquire various ventures. According to Finnish custom the sale price was not disclosed.

In Vartiovaar's opinion, the selling of Automation, which was detached about one year ago from the parent corporation to operate as an independent department, was not really that big a deal. He bases his assertion on the facts that Automation accounted for only two percent of Rosenlew's total money turnover and that hi-tech know-how exists in other departments as well.

Rosenlew's activation of it's robot factory in Ulvila in 1981 meant an entry into a new field for the corporation. The municipality of Ulvila constructed the buildings for the factory. Robots from there have been delivered to, among others, Wartsila, the present purchaser of the plant.

The Rosenlew robot factory has been dramatically successful. In just a few years the number of employees increased from the initial 50 to the present number which is more than three times as great.

The robot factory has even had to be enlarged on two different occasions. The municipality of Ulvila initially built 1700 cm<sup>2</sup> of factory space. Now the factory already has about 5000 cm<sup>2</sup> of space for operations. The municipality no longer owns the buildings containing the factory. They are currently owned by the Ulvila Automation Hall Real Estate Inc. There probably is an insurance company in the background. The Rosenlew robot factory is the second biggest employer in Ulvila.

Rosenlew's turnover last year was 1.5 billion with a net loss of 27 million Fmks. It is expected that the turnover will increase by 15% this year.

Last year only the packaging department at Rosenlew's managed to turn a profit.

Rosenlew was the only one not surprised by the deal. To everyone except Rosenlew management the sale of the automation department was a surprise. The department was widely considered to be a display of Rosenlew's high technology which had grown, proved sound and had kindled admiration.

According to Rosenlew the sale of the automation department is not a big deal since the company will continue to have high-tech skills in their packaging and in the threshing combine industries. An outsider is, nevertheless, puzzled by Rosenlew's future. The sale does not terminate speculation about the possible splitting up of the corporation. On the contrary, it adds fuel to it.

The corporation has tried many things. As sidelines to its forest products industry, it has developed plastics, paint and household appliances production, all of which have subsequently had their production terminated. A few years ago, Rosenlew relinquished its household appliances to Electrolux and received that company's threshing combine production in return.

Overall the last ten years have brought a net loss to Rosenlew. Production has not yielded a profit, which could have been used to develop the company's activity. Now the company has chosen packaging and threshing combines as their fields of concentration. Their prospects of success in the combine industry dominated by international giants can well be doubted.

The fate of Rosenlew's forest products branch is a subject for continuous speculation. The surest bet seemed to be that the corporation, one belonging to the camp of the Union Bank of Finland, would collaborate with other forest products firms on joint projects. The fusion of Metsaliitto and Serlachius destroyed that speculation and now Rosenlew seems to be a west coast loan ranger. Metsa Serla and Yhtyneet Paperitehtaat pressure them from the interior of the country.

According to Vartiovaara, the sawmill side of Rosenlew has good production machinery but there are problems in the chemical forest products area. Rosenlew has proclaimed its desire for joint projects even in its annual report.

To Wartsila the transactions are stylish. The corporation can simply explain that they are full in line with company strategy and strengthen the transformation of its internal structure.

They are also indispensable to Wartsila since the fusion of their shipyards with Valmet's only accented the stamp of a shipyard company that Wartsila has. Wartsila can be expected to acquire more ventures, since last year it mainly sold departments.

One possible buyer for the automation department could have been the development corporation, Mancon, founded by Gustaf Rosenlew. According to the executive deputy manager, Tapiio Vartiovaara, Mancon didn't even know that the automation department was for sale despite the fact that Rosenlew is chairman of the board of governors for both corporations.

The orders by cathode ray tube factory Valco are what got the robot facotry going well and now the managements of both Rosenlew and Wartsila are ready to praise the State for unbiased activity for the good of industry.

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## WEST EUROPE/LASERS, SENSORS AND OPTICS

### FRG LASER PRODUCERS, PROJECTS, FUNDS

Rijswijk PT/AKTUEEL in Dutch 13 Aug 86 p 17

[Article: "Laser Technology Taking Off Too in FRG"; first paragraph is PT/AKTUEEL introduction]

[Excerpts] Lasers and laser techniques are enjoying growing popularity in the Federal Republic of Germany too. More and more firms and research institutes are working with them. In part due to support from the Federal Ministry for Research and Technology, research and production of this high technology has grown some 30 percent a year since 1980. This article, the data of which comes from the technical-scientific section of the Netherlands embassy in Bonn, explains the state of affairs as regards the projects, the producers, basic and applied research in our neighbor to the East.

#### Producers

In the Federal Republic at present there are 12 [sic] firms intensively involved in the production of lasers. Haas, Laser Optronic, MBB Medizintechnik, and Meditech produce solid state lasers. WC Heraeus, Laser Innovation, Messer Griesheim, Rofin-Sinar Laser, Siemens, and Triumph make carbon dioxide lasers. Lambda-Physik concentrates on the excimer laser. In addition, Siemens and Meditech are also involved in the production of argon lasers, while Siemens is also the only one that makes helium-neon lasers.

Rofin-Sinar (carbon dioxide equipment), Siemens (helium-neon lasers and semiconductor lasers), and Lambda Physik (excimer and dye lasers) have an important share of the domestic market. Even so, the Federal Republic imports the majority of its laser systems from abroad; the German manufacturers' share of the radiation-source market is about 40 percent, for instance. There is the same problem with advanced, high-capacity lasers. Components with infrared optics and laser rods are all imported from the United States.

#### Basic Research

Most laser specialists in the Federal Republic work at universities and in research institutes. Areas of concentration are spectroscopy, plasma physics, materials research, solid state physics, and quantum optics. In 1976 the Federal Ministry for Research and Technology and the Max Planck Society

established the laser development project group, which became part of the Max Planck Institute for Quantum Optics in 1981. The project group, which employs 100 people, directs its basic research toward laser chemistry, laser spectroscopy, high-capacity lasers, and theoretical quantum optics.

Elsewhere, too, one finds interesting work being done. For solid state lasers, research is being done at the Technical University in West Berlin, the PTB Physical-Technical Institute in Braunschweig, the Battelle Institute in Frankfurt, the University of Hannover, and the University of Kaiserslautern. Six institutes are working on ultrashort light pulses: the universities of Bayreuth, Essen, Kaiserslautern, Regensburg, West Berlin, and Munich. Laser materials are the subject of research at the universities of Hamburg and Stuttgart. At those the main interest is research into new crystals, which are important for future lasers. Nd-YAG crystals are still not being manufactured in West Germany.

A number of firms and institutes are already producing semiconductor lasers. The best-known are Siemens, AEG Telefunken, Telefunken Electronic, Standard-Elektrik Lorenz, the Technical University of Munich, the Max Planck Institute for Solid State Physics in Stuttgart, and the Heinrich Herz Institute in West Berlin. A pioneer in the area of extremely short pulse lasers is Prof. Dr. F.P. Schaefer, director of the Max Planck Institute for Biophysical Chemistry in Goettingen. Schaefer has created a laser department at this institution. His research team now wants to develop a laser in the X-ray range, which makes pulses with a duration of 10 to the -18 seconds possible.

#### Applied Research

Several new institutes are interested in applied research, and laser techniques are developed there for industry. These are the DFVLR [German Research and Development Institute for Air and Space Travel] Institute for High Energy Processes in Stuttgart and the Laser Medicine Center in West Berlin. In the planning stage are laser medicine centers in Luebeck, and Ulm and the Institute for Applied Research in Solid State Lasers in West Berlin. These will give the Federal Republic adequate capacity for precompetitive research. The Federal Ministry for Research and Technology is supporting this research. The Ministry too has set up a research program for physical technologies with the intention of linking the German laser industry up with the international market. The program is organized by the VDI [Association of German Engineers] Technology Center. Industrial firms, research institutes, and technical universities are supposed to submit applications, after which the Technology Center evaluates the projects. An important criterion is that the knowledge must be available to other firms and institutes. The government's support is directed particularly toward laser radiation sources, laser components, laser systems, and process development. The Federal Ministry is supporting these projects in the 1985-89 period with the sum of DM 140 million. The condition is laid down that collaboration must be established between institutes and firms. In part because of this regulation, Lambda Physik in Goettingen has won a world monopoly in excimer lasers. Too,

the firms Haas Strahltechnik (crystal lasers), Rofin-Sinar in Hamburg and Messer Griesheim in Frankfurt (carbon dioxide lasers up to 2 kW) have profited from this support arrangement.

West German industry has also leaped at the Eurolaser European technology project agreed on during the second ministers conference in Hannover. The participating countries are France, Great Britain, and Italy. The goals of Eurolaser are to develop carbon dioxide lasers with a power of 10-100 kW for materials processing, solid state lasers from 1 to 5 kW, and excimer lasers with a power of up to 10 kW.

If all parties continue to cooperate, laser technology in Germany will have a great future.

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WEST EUROPE/LASERS, SENSORS AND OPTICS

BRIEFS

NETHERLANDS HIGH-TECH SUBSIDIES--State Secretary for Economic Affairs P.H. van Zeil has earmarked 4.7 million guilders for the Medium and Small-Sized Business Research Program (OMK), which is supposed to stimulate new high-tech activities in small and medium-sized firms. The experimental program, which will last about 2 years, has been set up within the framework of the Areas of Concentration Policy. The program will start within the next few weeks. The implementation of the program has been turned over to the Technical Sciences Foundation, which is responsible for evaluating and selecting project proposals. In doing so it is supposed to take into account both the quality of the firms and the technical quality of the proposals. The Foundation will cooperate with the National Industrial Service (RND) in carrying out the program. [Text] [Rijswijk PT/AKUEEL in Dutch 18 Jun 86 p 6] 12593

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WEST EUROPE/MICROELECTRONICS

BRIEFS

THOMSON IN 40 ESPRIT PROJECTS--Paris--Between 1983 and 1985, Thomson has made over 100 proposals to the Esprit program. Currently, the group is participating in 40 projects, for a total of 580 million francs, while the total budget for these projects is 2.7 billion francs. Mr Pierre Lepetit, the group's director of technical cooperation, summarized the main areas of Thomson Esprit participation for the press. They are: multilayer interconnection of VLSI electronic circuits, signal processing algorithms, an expert system generator, three-dimensional integrated circuits, quantum effect semi-conductor devices, integrated circuits and hardware, submicron technology bipolar integrated circuits, indium phosphorous electronic components, master slice integrated circuits, liquid crystal flat screens, X-ray microlithography, gallium arsenide circuit packs, new display modeling techniques, office-automation system design tools, VLSI integrated circuit assisted design methods (AIDA), parallel associative machines, and a coherent parallel optical processor.

[Text] [Paris AFP SCIENCES in French 10 Jul 86 p 13] 13014/12781

FRENCH-SPANISH VENTURE--Bull and Spain's INI [National Institute of Industry] have just signed a draft agreement on technical and industrial cooperation, under which Bull's will acquire of 40 percent of the capital of the Spanish computer firm Telesincro, located in Catalonia. This agreement, which is subject to approval by French and Spanish government authorities, also stipulates that INISEL (an INI-owned electronics group) is to retain 30 percent of its subsidiary Telesincro and that the remaining 30 percent must be acquired by another Spanish investor--probably a bank, according to Bull. This draft agreement follows a subcontracting agreement between Bull and INI that has allowed Telesincro to manufacture Bull Questar/T terminals and Bull Micral microcomputer subsystems since 1980. The 1986-88 business plan drawn up for Telesincro by INI and Bull provides for an overall investment of 50 million francs, to be used to build new factory and put together a research and development unit. According to Bull, this agreement "allows Telesincro to achieve a world-class industrial and technological capability." [Text] [Paris ELECTRONIQUE ACTUALITES in French 27 Jun 86 p 1] 13014/12781

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

FRG-USSR EXCHANGE AGREEMENT: BASIC RESEARCH, S&T APPLICATIONS

Duesseldorf VDI NACHRICHTEN in German 1 Aug 86 p 2

[Article by G.H. Altenmueller, "The Federal Republic of Germany and the USSR Come Closer: Basic Research as a Common Task: Scientific Technical Collaboration in a New Political Context"]

[Text] The scientific-technical collaboration between the Federal Republic of Germany and the Soviet Union finally has now also received a political-governmental context. After 15 years of discussions and negotiations, the foreign ministers Genscher and Shevardnadze as well as the Federal Research Minister Riesenhuber signed a governmental agreement in Moscow on 22 July. Just like the departmental agreement that builds on it, it also includes West Berlin.

The political signal given by this agreement has special political importance: The Soviet Union wishes to improve its relations with the FRG. The Berlin hurdle was overcome with the "Frank-Falin" general clause, according to which the agreement, in accord with specified procedures, is also extended to West Berlin. The names of the participating scientists are cited in the program discussions which must still take place; however, if they belong to federal institutes in Berlin, they will not be added.

The agreement concerning scientific-technical collaboration between the FRG and the Soviet Union comprises the exchange of information, joint symposia and conferences, the exchange of scientists and technical consultants, coordination of research projects, joint work in basic and applied research, and "joint research and development of new technological processes as well as methods for their application in production."

In terms of content, the framework agreement will be fleshed out with special technical agreements. Three departmental agreements have already been initialed: nuclear research and the peaceful use of atomic energy, agricultural research, and medical research. Furthermore, an agreement on environmental research is in prospect. As other areas, the framework agreement is expecting: energy technology, research and utilization of outer space, biology and bioengineering, data processing, information and documentation, R&D in traffic, educational research, as well as individual projects in machine construction, metallurgy, electronics, computer technology, and chemistry.

The first program agreement regarding collaboration in the peaceful utilization of nuclear energy is to become effective in 1987, initially for 2 years. For years, the Soviet Union has been interested in intensifying collaboration in the area of nuclear fusion. For this purpose, contacts between the Max-Planck Institute for Plasma Physics, Garching, and the Kurtschatov Institute for Nuclear Power are to be expanded.

The governmental agreement does not directly concern scientific collaboration between the German Research Association (DFG) and the Soviet Academy of Sciences, which has already been successful since 1970, as well as the Ministry of Health in Moscow. Naturally, the latter will also profit from the improved climate.

The DFG has kept itself strictly apart from all political implications. At this time it is funding more than 40 projects of scientific collaboration with the Soviet Union. For example, German experiments flew on both Soviet Vega probes, and Soviet experiments flew on the correspondingly coordinated European Comet probe Giotto. Just in 1985, within the framework of DFG agreements, 143 German scientists briefly stayed in the Soviet Union and 102 Soviet scientists briefly stayed in the FRG. Over the longer term, 22 German and 28 Soviet scientists performed research at institutes of the partner country.

In its recently published annual report, the DFG emphasizes that, as compared to an exchange of scientists according to quotas, project-related collaboration with the Academy of Sciences in Moscow has become more and more important in recent years, as far as the scope but even more the quality is concerned.

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CSO: 3698/673

WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

SCIENTIST RECRUITMENT, PERSONNEL POLICIES AT CNRS OF FRANCE

Paris APF SCIENCES in French 3 Jul 86 p 8

[Text] Paris--Following publication of a communique on "temporary measures" taken by management to ensure recruitment continuity and normal laboratory operation, CNRS [National Center for Scientific Research] sources have indicated that around 350 young researchers will still be brought in on a 1 year contract, despite suspension of normal recruiting procedures as a result of the 12 May Council of State ruling.

"Hiring will be subject to the decision of the general manager based on the opinion of the expert committee" appointed by management and "as close as possible to the boards that have existed up until now," according to our source.

The Council of State's decision invalidates the procedures for election to the CNRS National Committee, the "parliament" of the largest French research institution. Consequently, it has been necessary to eliminate the researcher selection boards on which committee members sat. Last week, "selectable" young scientists organized several demonstrations to protest this state of affairs. The management communique released 30 June is intended to provide more specific information.

Of the 500 research positions previously open, the management communique emphasized that "right now, around three-quarters of the positions reserved for recruitment will be filled in this way," specifying that these contracts would be offered to young university and prestige school [grande ecole] graduates who had applied. As for the remainder, the communique added that "the special relations between higher education and CNRS, in the concrete form of temporary posting of faculty researchers, will continue on an agreement, delegation, or availability basis. The same will apply to secondary school faculty. In the case of other government employees, CNRS will propose a similar mechanism to the administration that employs them."

Problems directly related to scientific careers (promotions, reassessments, etc.) will be dealt with in measures that "will be proposed at a later date." Our CNRS sources emphasized that the purpose was to take quick action to bridge the transition period caused by the invalidation of National Committee election methods and normal procedures for the competitive recruitment of researchers.

Promotion of engineers and technical and administrative staff "will take place as scheduled in the fall based on the opinions of the joint administrative committees. As in the case of research staff, competitive recruitment will be replaced by 1 year contracts, pending resumption of regular procedure." CNRS management indicated that "internal competitive exams will continue to be held" and that "boards will be put together as soon as they can be appointed under normal conditions."

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CSO: 3698/647

WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

NETHERLANDS COMMENTARY ON NEW EUREKA PROJECTS

Amsterdam ELSEVIER'S WEEKBLAD in Dutch 5 Jul 86 p 22

[Article by Willem Kraan: "'It's Not Always Clear What Eureka Adds"'; passages within slantlines emphasized in original; first paragraph is ELSEVIER'S WEEKBLAD introduction]

[Text] Originally the Eureka initiative was intended as the European counterweight to the American Star Wars program. Has that ambition been fulfilled? Or are they just throwing some things together? The 14 projects that the Netherlands is participating in make you fear the worst. Eureka as a hot-air balloon?

After more than a year and three flag and banner-decked ministers conferences, the question arises whether the Eureka initiative that was intended as the counterweight to the American Star Wars program has produced any results yet. Has Eureka become what its French initiators intended it to be? Has it become a shield against the American-Japanese technological invasion of the European markets? Or has the whole plan turned out in the end to be not much more than a kind of industrial directory, handy for firms in search of international partners?

Regardless of what the answer may be, European leaders have warmly embraced Eureka in any case. Even Margaret Thatcher, not exactly the pioneer in the process of European unification who most speaks to the imagination, describes Eureka affectionately as a drug against the Archimedes Syndrome: a disease that explains why a multiplicity of brilliant ideas simply will not lead to a torrent of market-ripe products. Eureka is supposed to do something about that. "A technological renaissance" is what they called the whole undertaking just a year ago. In order to see if it is more than a rather disorderly technological afterbirth, possibly the best thing to do is to take a look at the projects that been given the Eureka stamp of approval amid much ministerial hullabaloo.

Eureka Status

Some 60 projects enjoy Eureka status. That is a lot more than the 10 projects approved last year by the assembled ministers at the second Eureka conference in Hannover. Those first 10 were "not all exactly new, and not all exactly

brilliant either," according to the head of the Netherlands Eureka secretariat, Mr. Pol van den Bergen. Are the projects on the list now new and brilliant? "I doubt whether that's true of all the projects," Van den Bergen says, "but there certainly are some very good ones on the list."

One of the most conspicuous projects happens to be one that the Netherlands is not participating in, for the simple reason that our little country has not been blessed with an independent automobile industry. Volvo (the parent company from Sweden), on the other hand, is participating with 12 other European automobile manufacturers in the Prometheus project. And however odd it may sound, this mythological name does mean something: PROgramme for a European Traffic with Highest Efficiency and Unprecedented Safety. Prometheus basically amounts to a gigantic automobile computerization project. A computer in the automobile will aid the driver with all critical tasks, in roughly that same way that the anti-blocking system's microprocessor already prevents undesirable skidding.

But that is not all. The computers in the individual cars will also be in contact with one another so that the one car can take the other automobile's behavior into account. Chain-reaction collisions in the fog and fatal passing maneuvers will all be a thing of the past then. Sensors will also provide the computer with information about what is happening in blind spots where the driver normally cannot see.

At a later stage computers will be installed along the road, and of course these will in turn be in contact with the automobiles on the road. In this way the driver will always have information about where he is, where the nearest parking place is, the closest gas station, or the first hotel. And of course the system will immediately sketch out the most convenient route for the driver.

The communication system between driver, roadside computer, and automobile computer will produce not just a drastic improvement in road safety, but also a considerable improvement in traffic efficiency. Today, each driver just does his own thing, where he feels like it, when he feels like it. When electronic expert systems take over part of that responsibility, there will be substantial reductions both in air pollution and in the average size of traffic tie-ups, without our having to cover the notorious bottle-necks completely over with asphalt.

Naturally, nothing is free. The 13 automobile manufacturers expect to have to spend some 140 million guilders a year on research for the next 8 years. How much of that will come from the not-very-full European purse is still not known. Only the West German government has spoken up, promising to pump DM 6 million into the project the first year. As with all projects, the vast bulk of the money will have to be furnished by the companies themselves.

Philips has been working for some time on a video-disk system that is linked to a computer and can provide the driver with all kinds of information about location and the best route to take. This project has also been adopted by the Eureka organization, under the name Carminat, although France first blocked it for a time. It is said that the overlap with the Prometheus

project and Philips' too prominent role in Carminat had something to do with the obstruction.

#### HDTV Project

Of the 62 projects approved last month in London by the Eureka ministers, 14 involve Netherlands participation. That is not a bad score. In particular, the civil servants involved in Eureka talk highly of the HDTV project, in which Philips, as the primary participant, has developed a television system with considerably improved picture and sound quality. /Has/ developed? But Eureka projects are exclusively for promising new technologies that still have to be developed, aren't they? This is where we come to the embarrassing question of just what Eureka status really adds to the projects selected. Would the projects not have been undertaken in any case? And are they all really sufficiently "high tech" to take Star Wars as a model? And are they all based on market needs?

"I admit that it's still not always clear what Eureka adds," says Van den Berge. "Still, there /are/ a couple of clear advantages to the Eureka approach. Anywhere you have to work with norms, rules, and standards, you have to see to it that you get the various Eureka governments to agree. A Eureka organization, in which the European Commission is also represented, can help with that. Furthermore, you have the alibi effect. I hear from participating companies that now they have a reason to go talk about a joint strategy with firms that in other ways they compete with tooth and nail. And last but not least, small and medium-sized companies can develop all kinds of relationships with the help of the Eureka secretariat."

Of course, it is a real pity that the list of Netherlands participants in Eureka projects does not include any small and medium-sized companies, unless we are supposed to draw the line at 1500 employees.

Participating companies generally confirm the usefulness of the Eureka secretariat as an intermediary. Mr. Den Boer of Wilma Vastgoed BV says that "thanks to the Eureka secretariat we've developed a number of international contacts we certainly wouldn't have otherwise. Just recently we got a call from the French Post, Telegraph, and Telephone's engineering office. They'd found us via the French secretariat."

Still, the question remains whether these projects would not have come into being even without the Eureka initiative. "Very possibly," says Van den Berge, "but probably not as fast and in a different form."

Precisely one of the few Netherlands projects that we have reason to think would not have come into being without Eureka, Eurotrans, has just been the subject of violent bickering and wrangling. Eurotrans is the collective name for a number of projects that are supposed to simplify and streamline the entire Eureka freight transport system. At one point the engineering office supervising the project had its full of bureaucratic "nitpicking" and threatened to advise the participating companies not to participate in the project any longer.

It did not come to that. Eurotrans is now advancing, step by step by step, and the first two subprojects were approved by the Eureka ministers in London: Transpotel (a project to make international freight traffic more efficient; 40 percent of all trucks return empty) and Transpolis (the development of industrial parks with advanced communications, transport, storage, and service facilities; Schiphol and Rotterdam have been chosen as the first locations).

Agree

Eurotrans is a typical example of a project that can succeed only if all participating European countries agree. Eureka can play a role there. Still, any supporter of greater European cooperation will point out that the European Community very likely was the appropriate body to accomplish that. Eureka is now getting an international secretariat in Brussels (a decision that was also blocked for some time by the French), and the Belgian capital is thus being honored with the nth organization intended to exorcize the many-headed monster of European multiplicity.

Looking at the many other projects in information technology, production automation, new materials, communications, biotechnology, and environment, we cannot help but find that Eureka has been anything but an essential condition for them; at most it has been a stimulus. Thus the Eureka ministers once again showed themselves in London to be masters at the art of blowing up and releasing pretty, bright-colored, hot air balloons with a rich verbal rigging.

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CSO: 3698/691

WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

CIPI RESOLUTION APPROVES FUNDS FOR ITALIAN RESEARCH PROJECTS

[Editorial Report] Rome GAZZETTA UFFICIALE DELLA REPUBBLICA ITALIANA in Italian No 187, on 13 August 1986 publishes a resolution of the Interministerial Committee for the Coordination of Industrial Policy (CIP) concerning the admission of project proposals to the Special Revolving Fund for Technological Innovations. The following are selected records from this document which identify the companies admitted to the fund, research projects, and the terms of financing for government sponsorship:

AERITALIA -- SOCIETA' AEROSPAZIALE ITALIANA S.p.A., Naples, large company classification.

Program: Prediction and measurement of radar cross sections and radar images of aircraft.

Place of execution: Northern Italy.

Form of financing: Credit available at an annual rate of interest established by a decree of the treasury minister; subsidy.

Maximum amount: a) 3,291 million lire in the form of easy credit not to exceed 35 percent of the allowed costs; b) 3,291 million lire subsidy not to exceed allowed costs.

Duration: Eight-year amortization period in addition to the time needed for the research program. The latter must not exceed 4 years.

Amortization: Sixteen, semi-annual, equal-deferred installments, to be paid at the end of each 6-month period and inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 11 June 1985.

CRAI -- CONSORZIO PER LA RICERCA E LE APPLICAZIONI IN INFORMATICA, Rende, Cosenza, large company classification.

Program: Instruments for the integration of computer science systems: distributed query systems.

Place of execution: Southern Italy.

Form of financing: 1,022 million lire credit available at an annual rate of interest established by a treasury decree: subsidy.

Maximum amount: a) 1,022 million lire subsidy not to exceed 40 percent of the allowed costs.

Duration: Six-year amortization period in addition to the time needed for the research program. The latter must not exceed 3 years.

Amortization: Twelve, semi-annual, equal deferred installments, to be paid at the end of each 6-month period and inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 May 1985.

CSELT -- CENTRO STUDI E LABORATORI TELECOMUNICAZIONI S.p.A., Turin -- SIRTI S.p.A., Milan, large company classification.

Program: Advanced techniques and systems for optical communication: installation and instrumentation technologies for fiber optic communications.

Place of execution: Northern Italy.

Form of financing: Easy credit available at the annual rate of interest established by a treasury decree; subsidy.

Maximum amount: a) 1,882 million lire easy credit available not to exceed 35 percent of one-half of the allowed costs of 10,756.2 million lire; b) 1,882 million lire subsidy not to exceed 35 percent of one-half of the allowed costs of 10,756.2 million lire.

Duration: Eight-year amortization period in addition to the time needed for the research program. The latter must not exceed 7 years.

Amortization: Sixteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, and inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: January 1, 1984.

INDUSTRIE PIRELLI S.p.A., Milan, large company classification.

Program: Rubber and short-fiber composite materials.

Place of execution: Northern Italy.

Form of financing: Easy credit available at an annual rate of interest established by a treasury decree.

Maximum amount: 1,288 million lire in easy credit available not to exceed 70 percent of the allowed costs.

Duration: Seven-year amortization period in addition to the time needed for the research program. The latter must not exceed 4 years.

Amortization: Fourteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 April 1985.

INDUSTRIE PIRELLI S.p.A., Milan, large company classification.

Program: Automatic visual analysis.

Place of execution: Northern Italy.

Form of financing: Easy credit available at the annual rate of interest established by a decree of the treasury minister.

Maximum amount: 910 million lire easy credit available not to exceed 70 percent of the allowed costs.

Duration: Six-year amortization period in addition to the time needed for the program. The latter must not exceed 4 years.

Amortization: Twelve, semi-annual, equal deferred installments, to be paid at the end of each 6-month period and inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 April 1985.

INDUSTRIE PIRELLI S.p.A., Milan, large company classification.

Program: Processing of elastomers.

Place of execution: Northern Italy.

Form of financing: Easy credit available at an annual rate of interest established by a decree of the treasury minister.

Maximum amount: 1,631 million lire easy credit not to exceed 70 percent of the allowed costs.

Duration: Seven-year amortization period in addition to the time needed for the research program. The latter must not exceed 4 years and 6 months.

Amortization: Fourteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program

Starting date of the program: 1 June 1985.

INDUSTRIE PIRELLI S.p.A., Milan, large company classification.

Program: Computer-aided formulation of mixtures.

Place of execution: Northern Italy.

Form of financing: Easy credit available at an annual rate of interest established by a decree of the treasury minister.

Maximum amount: 1,187 million lire easy credit not to exceed 70 percent of the allowed costs.

Duration: Eight-year amortization period in addition to the time needed for the research program. The latter must not exceed 4 years and 6 months.

Amortization: Sixteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 April 1985.

SOCIETA' CAVI PIRELLI S.p.A., Milan, large company classification.

Program: Telecommunications systems using underwater fiber optic cables.

Place of execution: Northern and southern Italy.

Form of financing: Easy credit available at the annual rate of interest established by a decree of the treasury minister; subsidy.

Maximum amount: a) 8,437 million lire easy credit available not to exceed 35 percent of the allowed costs, of which 473 million lire is to be allocated to the north and 7,964 million lire to the south; not to exceed 40 percent of the allowed costs, b) 8,437 million lire subsidy not to exceed 35 percent of the allowed costs of which 473 million lire is to be allocated to the north and 7,964 million lire to the south; not to exceed 40 percent of the allowed costs.

Duration: Eight-year amortization period in addition to the time needed for the research program. The latter must not exceed 5 years.

Amortization: Sixteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period and inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 May 1985.

I.P.M. -- INDUSTRIA POLITECNICA MERIDIONALE S.p.A., Naples, large company classification.

Program: Telematic equipment.

Place of execution: Northern and southern Italy.

Form of financing: Easy credit available at the annual rate of interest established by a decree of the treasury minister; subsidy.

Maximum amount: a) 6,490 million lire easy credit not to exceed 35 percent of the allowed costs of which 154 million lire is to be allocated to the north and 6,336 million lire to the south (40 percent of the allowed costs); b) 6,490 subsidy not to exceed 35 percent of the allowed costs of which 154 million lire is to be allocated to the north and 6,336 million lire to the south (40 percent of the allowed costs).

Duration: Eight-year amortization period in addition to the time needed for the research program. The latter must not exceed 6 years.

Amortization: Sixteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 January 1986.

ITALTEL -- SOCIETA' ITALIANA TELECOMUNICAZIONI S.p.A., Milan, large company classification.

Program: System for the remote control of power networks.

Place of execution: Southern Italy.

Form of financing: Easy credit available at an annual rate of interest established by a decree of the treasury minister; subsidy.

Maximum amount: a) 5,299 million lire easy credit available not to exceed 40 percent of the allowed costs; b) 5,299 million lire subsidy not to exceed 40 percent of the allowed costs.

Duration: Eight-year amortization period in addition to the time needed for the research program. The latter must not exceed 6 years.

Amortization: Sixteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period and inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 January 1986.

ITALTEL TELEMATICA S.p.A., S. Maria Capua Vetere (Caserta), large company classification.

Program: Computer phone.

Place of execution: Northern and southern Italy.

Form of financing: Easy credit available at the annual rate of interest established by a decree of the treasury minister; subsidy.

Maximum amount: a) 7,428 million lire easy credit available not to exceed 35 percent of the allowed costs of which 1,036 million lire is to be allocated to the north and 6,392 to the south (not to exceed 40 percent of the allowed costs); b) 7,428 million lire subsidy not to exceed 35 percent of the allowed costs of which 1,036 million lire is to be allocated to the north and 6,392 million lire to the south (not to exceed 40 percent of the allowed costs).

Duration: Eight-year amortization period in addition to the time needed for the research program. The latter must not exceed 6 years and 6 months.

Amortization: Sixteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 January 1986.

TELETTRA -- TELEFONIA ELETTRONICA E RADIO S.p.A., Milan, large company classification.

Program: Digital system for data transmission.

Place of execution: Northern Italy.

Form of financing: Easy credit available at the annual rate of interest established by a decree of the treasury minister; subsidy.

Maximum amount: a) 2,384 million lire in easy credit available not to exceed 40 percent of one-half of the allowed costs of 11,921 million lire b) 1,788 million lire subsidy not to exceed 30 percent of one-

half of the allowed costs of 11,921 million lire.

Duration: Eight-year amortization period in addition to the time needed for the research program. The latter must not exceed 5 years.

Amortization: Sixteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be paid no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 November 1985.

T&T S.p.A., Naples -- ZELTRON S.p.A., Campoformido (Udine) -- SYSTEMS & MANAGEMENT S.p.A., Turin, large company classifications.

Program: Work station for the management of technological innovation.

Place of execution: Northern and southern Italy.

Form of financing: Easy credit available at the annual rate of interest established by a decree of the treasury minister; subsidy.

Maximum amount: a) 969 million lire easy credit available not to exceed 35 percent of the allowed costs, of which 359 million lire is to be allocated to the north and 610 million lire to the south (not to exceed 40 percent of the allowed costs); b) 969 million lire subsidy not to exceed 35 percent of the allowed costs of which 359 million lire is to be allocated to the north and 610 million lire to the south (not to exceed 40 percent of the allowed costs).

Duration: Seven-year amortization period in addition to the time needed for the research program. The latter must not exceed 4 years.

Amortization: Fourteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 January 1985.

Special conditions: a) That the company capital (600 million lire) of the Company T&T - Trasferimento di tecnologie S.p.A. be fully paid prior to stipulation of the contract; b) Guarantee to be provided as follows: 60 percent by Professor Eugenio Corti; 25 percent by a financial institution, 15 percent by Industrie Zanussi S.p.A., Pordenone.

## Article 2

The following research programs, which have already received some financing, will receive further financing from the Special Fund for Applied Research under the aforementioned laws, on the terms and conditions specified for each program:

AERMACCHI S.p.A., Varese, large company classification.

Program: Technological studies and research in jet aircraft used for basic/advanced and operational training.

Place of execution: Northern Italy.

Previous awards: M.R.S.T., July 25, 1984.

Form of financing: Easy credit available at an annual rate of interest established by a decree of the treasury minister; subsidy.

Maximum amount: a) Easy credit available: 2,508 million lire, of which: not to exceed 30 percent of one-sixth of the allowed costs in Italy, equal to 49,429 million lire (2,471 million lire); not to exceed 9.4 percent of one-sixth of the allowed costs outside Italy, equal to 2,382 million lire (37 million lire); b) Subsidy of 4,180 million lire, of which: 50 percent of one-sixth of the allowed costs in Italy, equal to 49,429 million lire (4,119 million lire); 15.6 percent of one-sixth of the allowed costs outside Italy, equal to 2,382 million lire (61 million lire).

(This gives the program 50 percent financing).

Duration: Eight-year amortization period in addition to the time needed for the research program. The latter must not exceed 6 years.

Amortization: Sixteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 January 1984.

FIAT AUTO S.p.A., Turin -- FIAT VEICOLI INDUSTRIALI S.p.A., Turin, large company classification.

Program: Innovative systems in technology for the automobile industry.

Place of execution: Northern Italy.

Previous awards: C.I.P.I., December 22, 1982; M.R.S.T., April 28, 1983, March 27, 1985, January 31, 1985

Form of financing: Easy credit available at an annual rate of interest established by decree of the treasury minister; subsidy.

Maximum amount: a) 3,549 million lire easy credit not to exceed 30 percent of 15 percent of the allowed costs of 78,870 million lire; b) 4,732 million lire subsidy not to exceed 40 percent of 45 percent of the allowed costs of 78,870 million lire.

(This gives the program financing for 85 percent of the total costs).

Duration: Eight-year amortization period in addition to the time needed for the research program. The latter must not exceed 5 years.

Amortization: Sixteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be paid no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 January 1982.

GTE - TELECOMUNICAZIONI S.p.A., Cassina de'Pecchi (Milan) -- TELETTRA S.p.A., Milan, large company classifications.

Program: Digital radio links for integrated networks using new designs.

Place of execution: Northern Italy.

Previous awards: M.R.S.T., January 31, 1986 and May 21, 1986.

Form of financing: Easy credit available at the annual rate of interest established by a decree of the treasury minister; subsidy.

Maximum amount: a) 6,057 million lire easy credit available not to exceed 40 percent of one-half of the allowed costs of 45,434 million lire; b) 6,057 million lire subsidy not to exceed 40 percent of one-half of the allowed costs of 45,434 million lire.

(This gives the program financing for two-thirds of the total cost).

Duration: Nine-year amortization period in addition to the time needed for the research program. The latter must not exceed 6 years.

Amortization: Eighteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 September 1982.

ITALTEL -- SOCIETA' ITALIANA TELECOMUNICAZIONI S.p.A., Milan, large company classification.

Program: Mobile radio systems for private networks.

Place of execution: Northern Italy.

Previous awards: M.R.S.T., March 18, 1986.

Form of financing: Easy credit available at the annual rate of interest established by a decree of the treasury minister; subsidy.

Maximum amount: a) 1,296 million lire credit available not to exceed 35 percent of one-half of the allowed costs of 7,404 million lire; b) 1,296 million lire subsidy not to exceed 35 percent of one-half of the allowed costs of 7,404 million lire.

Duration: Eight-year amortization period in addition to the time needed for the research program. The latter must not exceed 6 years.

Amortization: Sixteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, and inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 January 1982.

OSAI A-B S.p.A., Ivrea (Turin), large company classification.

Program: Basic hardware and software components and flexible systems for factory automation.

Place of execution: Northern and southern Italy.

Previous awards: M.R.S.T., July 5, 1985.

Form of financing: Easy credit available at the annual rate of interest established by a decree of the treasury minister; subsidy. Maximum amount: a) 2,948 million lire easy credit available not to exceed 40 percent of one-third of the allowed costs, of which 2,794 million lire is to be allocated to the north and 154 million lire to the south. The total allowed costs are: 20,960 million lire in the north; 1,115 million lire in the south. b) 2,948 million lire subsidy not to exceed 40 percent of one-third of the allowed costs, of which 2,794 million lire is to be allocated to the north and 154 million lire to the south. The total allowed costs are: 20,960 million lire in the north; 1,115 million lire in the south.

(This gives the program financing for two-thirds of the total cost).

Duration: Eight-year amortization period in addition to the time needed for the research program. The latter must not exceed 5 years.

Amortization: Sixteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 8 November 1983.

Special conditions: Guarantee from "Ing. C. Olivetti & C. S.p.A.", Ivrea.

S.G.S. -- MICROELETTRONICA S.p.A., Catania, large company classification.

Program: MOS LSI-VLSI integrated circuits, analog and digital-analog integrated circuits, discrete components and power integrated circuits in VDMOS technology.

Place of execution: Northern Italy.

Previous awards: M.R.S.T., July 5, 1985 and January 31, 1986.

Form of financing: Easy credit available at the annual rate of interest established by a decree of the treasury minister; subsidy.

Maximum amount: 27,015 million lire subsidy not to exceed 40 percent of 30 percent of the allowed costs of 225,131 million lire.

(This gives the program financing for 70 percent of the total cost).

Duration: Nine-year amortization period in addition to the time needed for the research program. The latter must not exceed 6 years.

Amortization: Eighteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 February 1983.

Special conditions: Guarantee from Stet -- Societa finanziaria telefonica per azioni, Turin.

TELETTRA -- TELEFONIA ELETTRONICA E RADIO S.p.A., Milan, large company classification.

Program: Integrated digital lines from 2 to 140 Mb/s for integrated networks using advanced technology and LSI.

Place of execution: Northern Italy.

Previous awards: M.R.S.T., October 29, 1985.

Form of financing: Easy credit available at the annual rate of interest established by a decree of the treasury minister; subsidy.

Maximum amount: a) 2,778 million lire in easy credit available not to exceed 50 percent of one-third of the allowed costs of 16,673 million lire; b) 1,667 million lire subsidy not to exceed 30 percent of one-third of the allowed costs of 16,673 million lire.

(This gives the program financing for two-thirds of the total cost).

Duration: Nine-year amortization period in addition to the time needed for the research period. The latter must not exceed 6 years.

Amortization: Eighteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 September 1982.

TELETTRA -- TELEFONIA ELETTRONICA E RADIO S.p.A., Milan, large company classification.

Program: Introduction of new services in the FRG.

Place of execution: Northern Italy.

Previous awards: M.R.S.T., October 29, 1985.

Form of financing: Easy credit available at the annual rate of interest established by a decree of the treasury minister; subsidy.

Maximum amount: a) 4,243 million lire easy credit available not to exceed 60 percent of one-third of the allowed costs of 21,215 million lire; b) 1,414 million lire subsidy not to exceed 20 percent of one-third of the allowed costs of 21,215 million lire.

(This gives the program financing for two-thirds of the total cost).

Duration: Eight-year amortization period in addition to the time needed for the research program. The latter must not exceed 6 years.

Amortization: Sixteen, semi-annual, equal deferred installments, to be paid at the end of each 6-month period, inclusive of capital and interest. The first payment must be made no later than the second due date following the effective date of completion of the research program.

Starting date of the program: 1 January 1983.

8616

CSO: 3698/M250

WEST EUROPE/TECHNOLOGY TRANSFER

EAST-WEST JOINT VENTURES: NEW OPPORTUNITY FOR COLLABORATION

Helsinki HELSINGIN SANOMAT in Finnish 21 Aug 86 p 2

[Article by Prof Ivan Ivanov, board member of USSR Chamber of Commerce and Industry]

[Text] In economic publications and commercial negotiations, there have recently been discussions about the possibilities for establishing hybrid Soviet and foreign corporations. The question of what pre-requisites there are for such joint ventures in the USSR has the most attention in these discussions.

At the USSR Communist Party delegate convention, special emphasis was given to the issue of commercial relations with foreign countries. According to the consensus of the convention, this would require new forms of economic cooperation. In the modern world of mutual dependence these are needed since the commercial relations between nations have increased. This has been an objective process in nature.

Joint ventures already exist. The strengthening of economic ties is not limited only to traditional forms of trade but has in recent times been extended ever more forcefully into the area of production. This can be seen in the foreign relations of the USSR in, among other things, compensation agreements, industrial cooperation and the development of multi-faceted scientific-technical cooperation.

The search for new forms of collaboration is especially keen within the Soviet Bloc, as shown by the introduction of the technology program, which extends until the year 2000, and was approved at the end of last year.

A new characteristic of the development of collaboration within the Soviet Bloc is that direct contacts at the enterprise level have been established, among other ways, by forming joint ventures.

Joint ventures involving the USSR already operate in Czechoslovakia, Bulgaria, Mongolia and Vietnam. The first joint venture to operate in the USSR was established in May of 1983. At that time, earlier experiences in, for

example, the actual processing of large investments when working together with other socialist countries were taken into consideration. In the 5-year plan just now beginning, there are several new and large cooperative projects.

Not only to Soviet Bloc countries. Ways are being formulated in the USSR to establish joint ventures with corporations from non-socialist countries which would then produce goods in the USSR. If the endeavors are chosen on a basis of mutual benefit and are managed with experience then this activity could produce positive results. It would be possible to share both the risks and profits and the exchange of technology, once begun, would continue. The collaboration would go beyond that allowed by existing compensation agreements. In principle, it is possible to establish joint ventures which are compatible with the Soviet legal code.

The topic has been discussed in the recent past by trade and economic commissions of the USSR and Japan as well as at the meeting of businessmen organized by the International Chamber of Commerce and the USSR Chamber of Commerce and Industry which took place in Moscow this past June. Among other matters, the discussions dealt with experiences gained from joint ventures operating in Eastern Europe and China.

Complementing role. It is clear that a reasonable role must be found right at the start for joint ventures in the overall affairs of the USSR's foreign commercial relations. The purpose for these ventures would not be to replace other forms of contact nor to govern these but to complement the existing structures wherever reasonable; to be one organized mode among others in the overall picture.

There is also reason to note that the structure used for managing commerce in the USSR undergoes revision as a matter of course. Therefore the forms of production selected for joint venture should be capable of complying with the changes in socialist production organization, which will initially grant the joint ventures unprecedented rights and responsibilities in the planning of operations, the application and monitoring of these plans, and in conducting foreign trade.

When the joint venture is formed, agreement should be reached about the direction that the commercial activities of the venture will take. The proposals expressed by the foreign corporations lead one to surmise that they see joint ventures chiefly as a means of replacing their exports. For them, joint ventures are a way of entering the domestic markets of the USSR.

This view is expressed in, among other things, a communique presented by the International Chamber of Commerce in June in connection with a meeting of businessmen. It is clear that the USSR, for its part, would want the joint ventures to act as exporters for the USSR, including trade done in foreign exchange, utilizing the sales network that the corporation has abroad.

Legislation needed. Foreign enterprises would prefer to establish joint ventures primarily near the coasts or in the most developed regions of the

USSR. The USSR, on the other hand, is equally interested in the development of it's interior and its individual economic zones.

The issue also has it's political aspects. In some countries, the legislation concerning corporations and the monitoring of exports is based upon a principle of extritorialism. For example, the government of the U.S. requires that the overseas subsidiaries of U.S. corporations follow the law of the U.S. and not of the country they are located in. Such requirements cannot, in so far as they apply to the USSR, be honored.

A multitude of problems lack a concrete code for solution. These problems affect, for example, taxation, transfer of capital, methods of settling disputes and the governing of the ventures. The joint ventures might develop into competition for domestic endeavors and this necessitates the drafting of a code of operation.

Furthermore, existing laws on social security, labor relations, the right to file suit and applications for patents have to be reviewed and must be extended in those areas where they would apply to the operations of joint ventures.

We need to begin on a trial basis. It has been decided to form a committee of Soviet and foreign legal experts to clarify the legal issues.

At the discussions, it has also been deemed sensible to establish, for a trial period, two or three joint ventures and use their experiences later to draw general conclusions.

In practice, the problem of production oriented joint ventures operating in the USSR is undergoing solution. Such a solution requires the careful consideration of all problems, from social to technical ones, connected with it.

13002/13104  
CSO: 3698/678

## EAST EUROPE/METALLURGICAL INDUSTRIES

### INCREASED USE OF POWDER METALLURGY IN GDR

East Berlin STANDARDISIERUNG UND QUALITAET in German No 5, 1986 pp 126-127

[Article by Dipl. Eng. Frank Mueller, ASMW [Office for Standardization, Measurement, and Product Testing], Metallurgy Department: "High-quality Sintered Metal Products--A Significant Contribution to Refinement Metallurgy"; first paragraph is STANDARDISIERUNG UND QUALITAET introduction]

[Text] For the period ending in 1990 metallurgy has the task of meeting national needs and making products available for export by increasing the share of refined products of constantly increasing quality and in a wide variety (Footnote 1) ("Directive of the 11th SED Party Congress on the 5-Year Plan for the Development of the GDR National Economy in the Years From 1986 to 1990," Dietz Verlag, [East] Berlin, 1986, p 58). That means that through the use of more efficient and more modern technologies refinement in metallurgical processing must achieve a new higher level.

In the new stage of the realization of the Party's economic strategy it is a matter of mobilizing the entire mental and physical potential and especially to focus on increasing efficiency through new technologies and new products. To achieve this goal requires, among other things, the optimum refinement of metallurgical products with the most modern processing technologies. The primary focus of attention is the development of technologies which have a minimum of processing steps and are progressive in their savings of raw materials and energy. Powder metallurgy makes it possible to manufacture high quality ready-to-install parts and special materials using a limited number of technological steps. The current range of powder metal products in the GDR includes the following major categories:

- Iron powder, preform parts, and friction bearings made of sintered iron
- Hard metals for cutting tools, metal forming machine tools, and mining tools as well as wearing parts
- Semifinished products and preform parts made of the sintered refractory metals tungsten, molybdenum, and tantalum
- Nonferrous metal powders and finished parts produced from them using powder metallurgy

-Sintered frictional and sliding materials

-Sintered contacts

-Superfine powders for microelectronics.

The Thale Iron and Steel Works VEB is the exclusive manufacturer of iron powder and sintered iron preform parts as well as bronze bearings.

#### Necessity and Objectives for Powder Metallurgy

Because it is a material and energy saving technology, powder metallurgy is an important component of refinement metallurgy. In contrast with conventional processes, with powder metallurgy products there are material and energy savings of between 40 and 60 percent in addition to working-time savings of between 200 and 1,500 hours per metric ton. For example, 62 machine tools can be eliminated through the use of 1,000 metric tons of sintered preform parts in the metal processing industry. The user of powder metallurgical parts realizes a gain of approximately M 14,000 per metric ton (Footnote 2) (B. Reichmann, "Evolution of Powder Metallurgical Production in the Thale Iron and Steel Works VEB," Eighth International Powder Metallurgical Congress).

Table 1. Advantages of Powder Metallurgy

| <u>Category</u>  | <u>Manufacturing technology</u> |                          |
|--|---------------------------------|--------------------------|
|  | <u>Conventional</u>             | <u>Powder metallurgy</u> |
| Waste material<br>per finished part                            | 60 %                            | 5 %                      |
| Manpower requirement<br>for 1,000 metric tons<br>of production | 100 %                           | 60 %                     |
| Energy requirement<br>for 1,000 metric tons<br>of production   | 100 %                           | 40 %                     |
| Prime costs to<br>the user                                     | 100 %                           | 50 %                     |

Because of these strong economic advantages powder metallurgy plays a key role in our national economy as a processing technology for the development of new materials and components. The task set by the Party leadership of making fundamental changes in metallurgy necessitates further acceleration of the implementation of powder metallurgy between now and 1990. This will result in basic and technological research in powder metallurgy being reoriented based on its significance in the national economy. The objectives are to more than

double powder metallurgy production and to achieve quality equivalent to the international level; to increase research potential through the establishment of a college of powder metallurgy technology and to manage this potential according to the principles of the greatest efficiency; to triple the production of sintered metal products and to raise the level of complexity substantially through the introduction of leading-edge technologies. In addition, new products (forged parts, filters) and forward-looking technologies (introduction of wear resistant layers, sintered metal parts for roller bearings, isostatic pressing techniques) should soon find applications in the national economy.

The iron powder produced in the Thale Iron and Steel Works VEB is manufactured by two processes: air atomizing and water atomizing. The powder manufactured in various grain sizes is used in powder flame cutting and for the manufacture of welding electrodes, welding tape, sintered metal preform parts based on iron, iron bearings, preform parts made of nickel chromium steel, and powder metal forged parts.

The properties of the sintered metal products are fundamentally determined by the alloyed and unalloyed initial powders used. In this way, for example, density, strength, and especially dynamic stress resistance are increased through the use of the powder forging technology. In the manufacture of 1 metric ton of powder metal forged parts, in contrast with conventional technology, 1.8 metric tons of rolled steel are replaced, approximately 200 hours of labor and 10.5 MWH of energy are saved, and a prime cost reduction of M 3,900 per metric ton is achieved.

Another branch of production is powder rolling. By powder rolling and subsequent sintering, electrode submerged welding tape is produced principally for contracted submerged welding of wear resistant surface layers. The use of electrode tapes has proven to be worthwhile in the regeneration and plating of wearing parts, for example, in hot rolling and hot shearing and in surface welding on bulldozer scoops or excavator bucket pads. Increases in service life of up to 200 percent have been achieved (Footnote 3) (M. Koziolek, "Powder Metallurgically Produced Electrode Tapes for Surface Welding," STAHLBERATUNG [STEEL ADVISORY], No 4, 1983).

Production of sintered bronze slide bearings makes up the largest share of sintered preform parts. Savings in materials along with simultaneous increases in use value amount to 85 percent in contrast with massive slide bearings and roller bearings. More than 50 million such slide bearings are currently being used successfully in many devices and plants.

Increasing requirements for service life and reliability and higher running speeds and stresses at operational temperatures above 200 degrees centigrade make the development of new materials essential.

The production of sintered bronze bearings is continually increasing because of the expanded range of application. Especially important here is the development and manufacture of microbearings with inside diameters of  $\leq$  2 mm (micromotors and synchronous motors).

In contrast with previous comparable products, these bearings have three times the service life while achieving the required reliability. They offer optimum international values based on service life, reliability, and running speed.

#### Application of Powder Metallurgical Products in the User Industry

A priority task of the industry is to make a cost-effective impact on the national economy through the targeted application of powder metallurgically produced vendor parts.

Table 2 shows the application of powder metallurgical products in individual industrial sectors.

Table 2. Application of Powder Metallurgical Products in the User Industry

| <u>Sector</u>  | <u>Sintered<br/>preform parts</u><br><u>(Data expressed in percentages)</u> | <u>Sintered<br/>slide bearings</u> |
|--|---|------------------------------------|
| Ministry for Electrical Engineering and Electronics                                  | 7   | 51                                 |
| Ministry for Construction of Heavy Machinery and Equipment                           | 3   | 7                                  |
| Ministry for Construction of Machine Tools and Processing Machinery                  | 7   | 19                                 |
| Ministry for Construction of General Machinery, Agricultural Machinery, and Vehicles | 48  | 12                                 |
| Ministry for Construction Industry (metal working industry)                          | 29  | -                                  |
| Ministry for District Managed Industry   | 6   | 5                                  |
| Toy industry   | -   | 4                                  |
| Other  | -   | 2                                  |

The complex evolution permits extending the areas of application to highly stressed motor vehicle parts, power train parts, clutches, flanges, toothed components, nickel chromium steel preform parts for the chemical industry and pump construction as well as preform parts for the consumer goods industry, mechanical engineering, and electrical engineering/electronics.

The Thale Iron and Steel Works VEB has the task of supplying forged parts and sintered preform parts with piece weights of from 3 grams to 800 grams and extremely complex shapes for the GDR automobile industry. In 1990 approximately 60 percent of sintered preform parts manufactured will be used in automobile construction. That corresponds to the international level.

## Conclusions

With the comprehensive use of its own research and development capacities, the metallurgy industry can meet the demand for highly refined vendor products through the involvement of institutes and technical universities. The trend in refinement metallurgy is most clearly demonstrated by the example of powder metallurgy.

It is estimated that through automation, equipment linkage, and more extensive use of robotics and microelectronics the production increases envisaged can be achieved by 1990. The production of powder metallurgical forged parts will have increased by a factor of ten, the production of welding tape and the production of sintered metal parts made of rustproof nickel chromium steel (for the armature industry and motor vehicle manufacture) by a factor of three and one-half. Powder metallurgy products such as vendor parts will be manufactured in increasing quantities.

12666

CSO: 2302/39

EAST EUROPE/MICROELECTRONICS

GDR COMMENTARY ON CSSR MICROELECTRONICS PRODUCTION

Five-Year Plan Development

East Berlin AUSSENWIRTSCHAFT in German No 30, 23 Jul 86 pp 41-42

[Text] In the "main directions of economic and social development in the CSSR in the years 1986/90" the orientation will be toward further accelerating the pace of development in the field of microelectronics. Increasing the production of electrical engineering/electronics enterprises which fall within the purview of the ministry by 60% (1981/85: 51%) over figures for 1985 should lay the foundation for the broad application of electronics in the national economy.

The planned production increase in electrical engineering/electronics--which currently accounts for 18% of the production of the metalworking industry--is thus significantly greater than that of the metalworking industry itself (30%). Electronics is to take priority over electrical engineering, with a planned increase of from 80 to 200%. The greatest increase is planned for integrated circuits, production of which is to be tripled by 1990. The corresponding production figures for Tesla-Roznov, the center of production of component parts in the CSSR, is to be quadrupled within this period (see also AUSSENWIRTSCHAFT No 27, 2 July 1986, p 30).

Good Starting Point to Meet High Goals

The degree to which the high goals set for microelectronics can be attained depends to a significant extent on the results already achieved. From 1975 to 1983, for example, overall industrial production increased by an average of 3.7% per year, with an increase in production in the metalworking industry of 5.7% during the same period, however the increase in the production of integrated circuits averaged 22%, and 30% in the period 1983 to 1985. More rapid than the increase in overall production in the CSSR was the increase during the period 1975 to 1983 in the manufacture of electronic test equipment at an average of 7.1% per year, with an average yearly increase of 12% in the field of control engineering and 7.4% in data processing equipment. The supply of data processing equipment increased by 16% in 1984 and 35% in 1985 (both figures indicate increases over the preceding year's figures).

Electronic products have already significantly shaped the production structure in the field to a significant extent due to the priority which has been assigned to the development of such products. From 1975 to 1985, for example, the manufacture of integrated circuits in the electrical engineering/electronics industry increased from around 1% to 5% of overall production in that field. Similar increases were seen in the manufacture of other components, with active components (including vacuum components) increasing from around 3% to 5%, data processing equipment from around 6% to 11%, and control equipment from 6% to 8%. These four component groups thus account for roughly twice as high a percentage of production in the electrical engineering/electronics industry as a decade ago, and represent nearly 33% of overall production in the industry.

The most important event in this area between 1981 and 1985 in the CSSR was the expansion of the range of microelectronic components (including microprocessors). The development of large-scale integrated circuits (LSI) was carried through to completion, and the basis was established for the introduction of progressive technologies (CMOS); a very high level was reached in the production of scanning electron microscopes.

Emphasis is also placed on forced innovation activity in the field of communications, particularly in the areas of radio and television transmitters, fully automatic long-distance telephone exchanges and high-capacity electronic PBXs, as well as the start of licensed manufacture of color television picture tubes. (Sixty-five percent of the equipment in the color picture tube factory is of Czechoslovakian manufacture.)

The range of computer and automation products was expanded to include modern minicomputers and microcomputers--including one 32-bit microcomputer--and control systems for machine tools. Within the scope of multilateral specialization involving the CEMA member nations, CSSR production includes the "SM 50/40" and "50/50" microcomputers which can be used to control robots and manipulators, and the "SM 40/20" and "52/12" minicomputers which can be used for control of energy consumption and in automated networks for technological production processes.

New medium-sized computer systems were put into production such as the "EC 1027" which has a capacity of 400,000 flops and a 1 to 2 megabit operation memory (this memory is based on 16 Kbit memory circuits of Czechoslovakian manufacture). Personal computers and educational school computers for the domestic market based on Czechoslovakian microprocessors are also being manufactured. At the same time it is pointed out that the technical level of the products must be improved, and supply must be increased in order to meet the demand of the national economy in terms of computer- and automation-related products as well as advanced technical consumer goods based on integrated microelectronics, in particular entertainment electronics.

#### Points of Emphasis in Development

In the "main directions of economic and social development", emphasis is placed in particular on accelerating the pace of development of

microelectronic components including new integrated circuits and microprocessors, passive and contact components, as well as on optoelectronic components. Priority is assigned to the development of automation, control and test equipment for use in controlling technological processes, robotics, and automatic design and management systems. Additional areas of concentration in development and manufacturing are products in the fields of computer, medical and laboratory engineering, testing and communications--in the latter field, emphasis is placed on electronic telephone exchanges and optical communication systems. At the beginning of 1987, for example, the CSSR intends to begin large-scale manufacturing of glass fiber cables.

Production Figures for Selected Electronic Products

|                           | 1990 <sup>1</sup> | 1995 <sup>2</sup> |
|---------------------------|-------------------|-------------------|
| Integrated circuits       | 300               | 278               |
| Discrete semiconductors   | 178               | 267               |
| Vacuum components         | 178               | 159               |
| Passive components        | 173               | 200               |
| Entertainment electronics | 175               | 179               |
| Electronic Test equipment | 195               | 185               |
| Data processing equipment | 159               | 198               |

<sup>1</sup> 1985 = 100      <sup>2</sup> 1990 = 100

Future development and production of numerically controlled machine tools and processing machines is to be accelerated, and these machines are to be increasingly integrated into automated systems. The degree of automation of machines and equipment used in light industry is also to be increased. Here, emphasis is placed on the need to develop standardized modules for use in industrial robots and manipulators. In addition, microelectronic devices are to be used to an increasing degree in products in the heavy machinery sector, in particular in investment complexes, in order to increase reliability and effectiveness. A major reason for the use of microelectronics in the design of machine tools and processing machines is to increase their exportability.

The requirements for accelerating the development of microelectronics in the five-year planning period 1986/90 are being met by doubling investments as compared to the period 1981/85. (Overall investments in the national economy are to increase by 10 to 12%.)

The "long-term program of increasing the presence of electronics in the Czechoslovakian economy" is to be pursued more consistently than before. This program, confirmed in October 1984, comprises the following /2 state goal programs/ [in boldface]:

- Development of the material/technical foundation for increasing the presence of electronics in the national economy and
- Development of the application of electronics in selected areas of the national economy.

The program, to run until 1995, defines the development of the necessary components based on the national economic demand and creates the prerequisites for the use of microelectronics in machine construction, in other areas of manufacturing and in those non-manufacturing sectors of the national economy. In order to stimulate the application of microelectronics in the different sectors of the national economy, the practice of reducing the prices of components and final products, introduced in 1983, is to be continued.

#### Forced Expansion of the Special Materials Base

The provision of a wider assortment of higher quality special materials on a greater scale for use in microelectronics manufacturing is viewed as the basis for the realization of the two above-mentioned development programs. The establishment of this basis goes hand in hand with a high level of research and development activity and requires top-quality technology which in the past had to be imported. Problems in meeting demand through in-country production occur due to the fact that more than 2000 types of materials are required in small quantities. Representatives of the Czechoslovakian electrical engineering/electronics industry are of the opinion that the material base for microelectronics can be ensured only through increased use of the international socialist division of labor.

The scientific/technical basis for a significant increase in in-country production has been established. The demand and technical parameters have been established in 5 areas (metals, chemicals alone, thermoplastics, ceramics and glass) within the scope of state planning for science and technology. Here, efforts are concentrated on the development of new technologies, increasing production capacity (17 projects are currently being studied), substitutions for imported raw materials, increasing the quality of materials and labor productivity in their manufacture.

Among others, good results have already been achieved in the development and manufacture of polycrystalline silicon, the development of monocrystal technology for gallium-phosphorus semiconductors, the production of photosensitive solutions, the development and production of ultrapure metals as well as the development of new nonferrous heavy metals. In the area of metals, efforts are underway to expand the export capacity of specialized metal products in order to make available funds for the import of necessary materials.

The importing of special technological equipment and the setting up of new production lines have laid the foundation for the production of strategic materials as well as for the ability to be independent of a percentage of imported goods from capitalistic countries. For example, import savings have been achieved through intensive development in the production of special glasses and crystalline glass compositions with defined characteristics which can be used for a wide variety of components.

Trends in the development and production of microelectronic components are also pointing toward increased application of ceramic materials. Czechoslovakian sources anticipate that the demand for such products in the Czechoslovakian national economy will roughly triple by 1995. This will require the

provision of associated raw materials of increased purity as well as the development of new technologies.

#### Increased Use of the International Socialist Division of Labor

With respect to the further development of microelectronics and its main areas of application, the "main directions of economic and social development in the CSSR in the years 1986/90" refer to the need to increasingly make use of the international division of labor with the objective of increasing the effectiveness of production. Consequently, the percentage of electronic equipment exported and the percentage of imported equipment on the domestic market should both increase to 60% by 1990, up from 26% and 33% in 1982, respectively.

The foreign economic relations of the CSSR in the field of microelectronics and its application are concentrated to a great extent on the USSR. Among other specifications, the "Program of Long-Term Economic and Scientific/Technical Cooperation Between the USSR and the CSSR up to the Year 2000" provides for the following:

- development of a unified component base in electronics and microprocessor technology, as well as for special equipment
- development and production of equipment for automation
- creation of a new generation of computers as well as the broad application of same in automated systems for the control of technological processes, and use in CAD/CAM systems
- development of communications including optoelectronics, and
- cooperation in the field of home electronics.

Here, the CSSR makes use of cooperation with the USSR in science and technology in particular for the development of progressive technologies and the manufacture of products of the highest quality. Examples are complete groups of equipment for the manufacture of highly integrated circuits, the automatic layout of integrated circuits, as well as equipment for inspecting the surface characteristics of solid crystals. In addition to foreign economic relations with the other European CEMA nations, the CSSR is also engaged in furthering cooperation with Cuba, Vietnam, Mongolia, North Korea and Yugoslavia.

/Descriptors/ [in boldface]: CSSR; electrical engineering/electronics; EDPA; development (M): applications (M) 1986; 1990

#### Tesla Plant Production

East Berlin AUSSENWIRTSCHAFT in German No 30, 23 Jul 86 p 42

[Text] The Czechoslovakian Tesla Association for Home Electronics in Bratislava is planning production growth of more than 82% from 1986 to 1990. This dynamic growth is to be achieved through changes in the manufacturing program and comprehensive international cooperation. The production of a series of /new products/ [in boldface] has already started. These include video recorders, compact disc (CD) players, community television antennas, cable

television distribution boxes, cassette recorders and fluorescent lamps. The production output of color television sets and radios is being increased, while that of black and white television sets and portable radios will be gradually reduced up to 1990.

Within the scope of /socialist economic integration/ [in boldface], 15 agreements have been drawn up or signed; 7 of these fall within the scope of the Permanent CEMA Commission for Cooperation in the Radio and Electronic Industry, 3 each involve the Interelektron Organization and Soviet partners, and Hungarian and Polish companies will be involved with 1 agreement each. In cooperation with the Moscow production association "Rubin" and the association "Elektron" in Lvov, a fourth-generation color television set was developed. Further cooperation will cover development and production of a color television set with a series 51 picture tube. Tesla is also taking part in joint Soviet/Czechoslovakian development of a stereo radio with integral CD player. In addition, the Tesla Association has laid the groundwork for production of the "VM-12" video recorder, developed jointly with Soviet partners.

12644  
CSO: 2302/30

## EAST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

### ALBANIAN S&T CENTERS DEVELOP INFORMATION EXCHANGE SYSTEM

Tirana ZERI I POPULLIT in Albanian 10 May 86 pp 3, 4

[Article: "Telecommunications in the Service of the Ever More Scientific Management of the Economy," by Sokol Hoxha, deputy director of the General Directorate of Posts and Telecommunications]

[Text] The needs of the economy and of culture, the progress of science and of technology in various fields, require the further increase of communications capability and of the quantity of information, perfecting the means of communication even further. Each new stage achieved is accompanied also by the evolution of those means, aiming at the increase of the quantity, speed and fidelity of the flow of information from the source to the receiver.

For the development of telecommunications, as in every other field, our Party has followed a principled Marxist-Leninist policy in maintaining correct proportions in relation to other branches of the economy, and in coming to their assistance.

In executing the Party instructions and the directives of its 8th Congress, the telecommunications workers have tried to further increase the effectiveness of the means in use and to introduce daily and increasingly new means, the most advanced of this technology. Along with the familiar and traditional means, during the seventh 5-year plan, 1981-1985, important achievements were noted in the direction of introducing digital techniques in the transmission network, the further expansion of the teletype network at the center and in the districts, important foundations were laid for the creation of the data processing system and the use of computers, of the radio relay telecommunications network, etc. These applications of advanced technology and the other improvements of the system have increased and will increase significantly the volume of information exchange, the quality of communication, and especially they have reduced the time for its realization.

If the investments and the application of new techniques in the telecommunications networks in the cities have been constantly increasing, the expansion and perfecting of the means of communication are treated with the same priority in the countryside, where as is known, the larger part of our country's population live. Important measures have been taken by the Party to bring these services ever closer to the residents, the remote mountain farms, the industrial projects set up in these zones and the managing organs in the countryside. Since

the linkage of all the villages by telephone lines in 1973 the telecommunications workers have undertaken important and repeated actions for the full reconstruction of this important link, significantly improving the quality and capacity of communication, and further expanding telecommunication services in the countryside. Serving this purpose are also the opening of new offices, the expansion of services and the construction of new surroundings in the centers of agricultural cooperatives, the designs of which are devised by anticipating the development needs of telecommunication means and installations in the near and distant future. Meanwhile altogether apparent is the importance of the ability to have a 24-hour exchange of information for every extremity of the fatherland, for the harmonious and balanced development of the economy itself which the means of communication must serve ever more effectively.

In a discussion with workers and cooperativists of Berat District, Comrade Enver Hoxha emphasizes: "A thorough knowledge by our workers of the objective economic laws of socialism will make them penetrate to the heart of different economic phenomena and draw from them correct conclusions for a scientific management of our peoples economy, in order to execute with precision the correct revolutionary line of the Party." For telecommunication workers also, as for every sector, is laid out the important task of knowing and studying these laws, of determining the most efficacious and certain ways and means to achieve the continually increasing exchange of information.

The important achievements of technology and of telecommunications equipment are able to meet these needs, playing a more important role than ever in the process of the construction and of the economic and social development of the country.

The eighth-5 year plan, 1986-1990, proposes great tasks for the economic and cultural development of the country. They will be faced as they should be by further expanding scientific organization and management in each link of production, construction or service. It is precisely this demand for scientific management of the economy which the 13th and 14th plenums of the Party Central Committee sought, and the further improvement of the exchange of information, in order to better meet the ever greater tasks of society. Therefore the continual training to guide and better serve the introduction of new techniques, the creation of conditions for the gradual integration of different varieties of services into the telecommunications network, through the design of digital systems with integration of services; the publicizing and wider understanding by the users of the new services and of the possibilities which they offer for the proper utilization of the pertinent means, the creation of conditions for the further expansion of our television network realizing live telecasts to Tirana from the districts, the creation of technical conditions for the dial telephone network, etc., this constitutes the work program for the step-by-step increase and development of the national telecommunications network and its variety of services.

The practical implementation of this telecommunications prospect where the needs of television, radio broadcasting and data processing are coordinated, will raise the level of exchange of information in the weather service, in banking, in

the Albanian Telegraph Agency, etc., passing from the relatively low speeds of telegraphic and teletype transmissions up to the highest level of computer terminals with even greater speeds than those currently in use.

Since the practical values of contemporary means for exchanging information and especially of the data processing and data transmission are becoming better known every day, the increasing demand for these means by important sectors of the economy, as agriculture, transportation, industry, the mines, banks, the scientific-research laboratories and institutes, etc., which always and increasingly need the flow and processing of a great quantity of information both internally and from interacting sectors is only natural and understandable. But as the Party has emphasized recently, these problems cannot be understood and solved without coordination, cooperation and the coordination of needs, of problems and of the study-design work.

Comrade Ramiz Alia, during his discussion with the metallurgists of the "Steel of the Party" metallurgical plant said: "We have hundreds of devoted cadres, with a broad technical and cultural horizon, courageous in studies and experiments, just as we have greater material and cooperative capacities. The Party and the managers," he emphasized, "as well as the state organs must encourage and support able men, specialists, scholars, inventors and exemplary workers and must have more confidence in them."

In these instructions the telecommunications workers also find their tasks.

Within the confines of this article certain aspects of the problems of a field could be mentioned, for example, of the data processing and transmission system, which constitutes only one of the specialized directions of telecommunications to ensure the exchange of information. The telecommunications network is placed at the disposal of these services in order to assure the exchange of information between the data processing workers and the terminals installed in the particular centers in each locality. This electronic processing at a distance requires the augmentation of the telecommunications network with auxiliary equipment capable of executing the transmission of data. But in order to realize this the specialists must solve a series of important complicated technical problems such as: the determination of the nature of the requirements and of the flow class, the type of application, the volume of transmission in terms of the number of terminals and their distribution; quality parameters, such as erasure in the system, impulsive noises, interference from power lines, mini-outages, the choice of a commutator system, etc., which constitute an important problem linked to the future development of the whole data transmission network and to the economic effectiveness of the investments which will be made.

It is a duty of the telecommunications sector workers in cooperation with other relevant sectors of the economy to recognize and to offer solutions to the matters treated above by the most favorable alternatives, planning actions which will respond to them adequately today and in the future.

During the eighth 5-year plan, 1986-1990, we anticipate the expansion of new techniques in the field of broadcasting, the further development of the radio-relay telecommunication system, and the introduction of digital technology in commutators, which offer a wide range of services creating the conditions for the automation of the interurban network. Only a short time has passed since the introduction of the teletype service into our communication network, and today it constitutes a well-known service sought for its ease and precision in exchanging information together with the advantages of saving time. To meet the increasing requests for this service, new modern equipment will be introduced having a greater capacity of teletype subscribers and services than previously.

The treatment of the detailed technical-economic aspects which have to do with the practical realization of the matters already treated would constitute the object of a study by itself. In this direction a specially important place is taken by the expansion of the production of telecommunication cables in all their variety, beginning with the improvement and further expansion of cables of the urban network, the testing and production of cables specified for the data processing and transmission services of coaxial cable of different types and capacities, which will support the automation of interurban communication on a national scale. Valuable studies in certain of these directions have been made by specialists and workers of the wire mill at Shkoder and by specialists in the telecommunications directorate. For their practical realization, still better and more concrete cooperation between the respective ministries is needed.

"Our economy presently is at an advanced stage," emphasized Comrade Ramiz Alia, "where the intensive factors of its development are emerging always and increasingly in first place. This means that now more than ever it is required that work be done for productivity and quality, for profitability and high effectiveness in the use of all that potential: human, technical, material, organizational and scientific which we have created and which we are constantly strengthening." In a planned and centralized economy which serves the needs of the entire socialist society, high effectiveness is required also of the telecommunications sector. It is understandable how absolutely necessary the familiarization, deepening and further training of the specialists who work in various fields of telecommunications, is in order to increase the degree of user acquaintance with the new equipment and services for exchange of information. This need is dictated not only by the high scientific level of the invention of these pieces of equipment and of their applied technology, but also by their variety and constant evolution.

This task requires deep study and better cooperation by the General Directorate of Posts and Telecommunications with such institutions as the "Enver Hoxha" University of Tirana, the specialized secondary schools, the Academy of Sciences, the Computer Mathematics Center, the Center of Study and Design of Electronic Equipment, and the specialized enterprises of production.

The creation of possibilities for an ever-increasing information exchange, more accurate, more rapid and varied, will deepen yet further the integration of telecommunications in the economic and vital activity in our country, participating every day and more directly in the process of scientific management, of production, of construction and of service to the people.

EAST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

CSSR COMMISSION CHAIRMAN EVALUATES NUCLEAR ENERGY PROGRAM

Prague TECHNICKY TYDENIK in Czech No 32, 5 Aug 86 pp 1, 2

[Article by Eng Stanislav Havel, CSc, chairman of the Czechoslovak Commission for Atomic Energy: "Our Nuclear Program"]

[Text] The 17th Congress of the CPCZ set demanding tasks and goals for the further development of our society which can be called a historical milestone in building the socialist republic. The primary task is to ensure comprehensive intensification of the national economy, especially by substantial acceleration of progress in R&D. As stated in the political message of the CPCZ Central Committee to the 17th Congress, "the order of the times is to increase radically our ability to develop science and technology, to implement their results, and rapidly and as broadly as possible to apply technological innovations which bring significant results for society, a high technical level, and good quality production."

This requirement fully relates also to R&D in fields related to the implementation of the Czechoslovak nuclear program. In the past 5 years there have been many important changes in the organization and management of R&D as a result of the constant attention devoted to these problems by party and governmental agencies. The establishment of the Federal Commission for Research and Development and Investment Planning made it possible to apply more comprehensively the target program approach in the planning and management of science and technology tasks and to create a long-range concept of development for the main technical fields. The peaceful use of nuclear energy is unquestionably one of those fields and nuclear energy has a primary role in the construction of our fuel and energy complex. The high priority for the development of nuclear energy is reflected in the Comprehensive Program of R&D Progress in CEMA Member States up to the Year 2000. The third of its five priority areas is indeed the accelerated development of nuclear energy.

Nuclear energy is now an inseparable part of the fuel and energy complex in Czechoslovakia. Recently the second section of the nuclear electric power plant in Dukovany was put into test operation and today the CSSR has six energy reactors of the VVER 440 type with a unit output of 440 MW working reliably. Last year the nuclear power plants produced 14.6 percent of overall electric energy produced in the CSSR and their further construction is the main direction in providing for an increase in energy sources for the development of our

national economy. By 1990 another two 440 MW sections in Dukovany and the first two sections of the same power output in Mochovce, will become operational. Starting in 1992 reactors of the VVER 1,000 types with a unit power output of 1,000 MW will gradually become operational at the Temelin nuclear power plant. The installed capacity of nuclear power plants will reach 4,400 MW in 1990 and these electric power plants will produce about 30 percent of electric energy. In the year 2000 the output of Czechoslovak nuclear power plants will reach 11,280 MW and their share in the production of electric energy will be almost 60 percent.

At the same time extensive use of heat from nuclear sources is planned for community and industrial purposes. Through combined utilization of nuclear power plants for production of electricity and heat, their overall efficiency will increase from the current 30 percent to 60-70 percent. This also will increase the utilization of nuclear fuel to a substantial degree. By reducing the electric power output by 1 MW, it is possible to gain 3 to 7 MW of extracted heat, depending on the type of turbine and the heat extraction design. This year the first heat pipeline from Jaslovske Bohunice to Trnava will be put into operation and projects have been developed for utilization of heat from all locations of the Czechoslovak nuclear power plants. Heat production from nuclear sources will reach 3,150 TJ by the end of this 5-year plan and 10,280 TJ in the year 2000.

All these demanding goals are included in the state target program 01, Development of Nuclear Energy up to the Year 2000, which ensures the implementation of construction projects and the reliable operation of nuclear power plants, including the delivery of heat, the export of nuclear energy equipment and instruments, and the creation of essential scientific and technical prerequisites.

Oversight of this program's R&D is performed by the Czechoslovak Commission for Atomic Energy. The program of R&D work is directed mainly at current problems in operating and constructing VVER-type reactors and it provides solutions for the following types of problems:

- improving the process of constructing nuclear power plants and construction technology;
- development of nuclear energy equipment with the VVER 1,000 reactors;
- increasing the utilization and reliability of technical equipment of nuclear power plants with VVER 440-type reactors;
- improving preparations for operations, increasing reliability and safety, increasing fuel use, and improving personnel training;
- minimizing production, processing, and permanent storage of radioactive wastes from the VVER-type nuclear power plants;
- development of selected components and problems of acquiring fast reactors.

Part of the research work is also the processing of data essential for performance of national supervision over nuclear safety, which the commission ensures on the basis of Law No 28/1984 of the Collection /of Laws/.

In the proposal for the Eighth 5-Year Plan 1,862 million korunas in noninvestment funds are allocated for completing the tasks of R&D within the framework of SCP (State Target Program) 01.

The R&D content of SCP 01 is very closely connected to the third priority area of the Comprehensive Program of R&D Progress of CEMA Member States up to the Year 2000, which is the basis for effective intensification of international cooperation and for higher efficiency of the work of the Czechoslovak R&D base in nuclear fields as well. This area contains 17 tasks concentrated in four parts:

- accelerated development and improved efficiency of production of electric energy through construction of nuclear power plants with VVER-type reactors,
- introduction of nuclear energy in supplying general use and industrial heat,
- development of equipment for fast reactors and of a base for thermonuclear energy,
- improvement in the reliability and safety of nuclear power installations.

Czechoslovak departments and organizations are taking part in performing all the main tasks of the third priority area, while specific participation in executing individual tasks will result from national economic needs and capabilities. In Czechoslovak organizations, preparations for carrying out the tasks, the principle of joining scientific-technical and production cooperation is thoroughly applied so that the indicator of the degree of progress in the results becomes the resulting effect on the user. A current demanding task is to ensure the closest possible relationship between the R&D content of SCP 01 and the tasks implemented in the Comprehensive Program, with emphasis on preventing duplication in R&D work, reinforcing important tasks, and reducing, or even stopping, tasks which do not have a reliable guarantee of subsequent implementation and a return on funds expended.

We are entering the Eighth 5-Year Plan with new tasks in the energy utilization of nuclear energy. State R&D Program 15, Radionuclides and Nuclear Instrumentation Equipment, was approved for 1986-1995. The Czechoslovak Commission for Atomic Energy, as the overseer of this program, must concentrate its efforts on increasing economic efficiency, especially for newly started tasks, and on ensuring the planned implementation of the results of the program, which costs Kcs 3.6 billion.

The tasks established for the Eighth 5-Year Plan in the peaceful use of nuclear energy are exacting. Their execution will require not only all our initiative and efforts, but also a demanding, decisive approach in the spirit of the

conclusions of the 17th Congress of the CPCZ. Their successful mastery will mean a new qualitative leap forward in the development of our nuclear energy and equipment and simultaneously an important contribution to the development of the national economy.

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## EAST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

### DEVELOPMENT, IMPACT OF KEY GDR TECHNOLOGIES APPRAISED

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[Issue entitled "In Answer to Questions on Key Technologies" resulting from the teamwork of the Press Office under the chairman of the Council of Ministers with the ministries for science and technology, for electrical engineering and electronics and for materials management and with the State Planning Commission, the party's Karl Marx College under the SED Central Committee, the Academy of Sciences of the GDR, URANIA and the Chamber of Technology]

[Text] Key Technologies--Why and for What Purpose?

Today the increase in output of a national economy is increasingly being determined by such key technologies as microelectronics, up-to-date computer technology, and the computer-aided design, planning and control of production. The application of scientific knowledge in production is taking place at a speed never before seen in the history of productive forces. That makes it clear that internationally the scientific-technical revolution has entered a new stage.

Our economic strategy with a view to the year 2000, as decided by the 11th SED Congress, is aimed at linking the advantages of socialism even more effectively with the achievements of the scientific-technical revolution. It is the intent of socialism to utilize science and technology for people and their well-being. That is why we need peak performance. The orientation in this direction, as is also reflected in the comprehensive program for the scientific-technical progress of the CEMA member countries through the year 2000, turns out to be a political and strategic question of the first magnitude, especially since the strategy of aggressive imperialist circles is based on the illusion that they have a monopoly on the decisive qualitatively new directions in science and technology, enabling them to achieve economic as well as military superiority on this basis. Seen in this light, the motive for the action of millions of working people of the GDR--"my job is my battlefield for peace"--is in profound agreement with the requirements of our time.

The broad application of key technologies in our national economy represents a tremendous challenge to the creativity of the working people and also presents

chances, as Erich Honecker stressed at the 11th SED Congress, "to renew production quickly, to improve its quality, and to reduce outlays to an extent that has not been possible heretofore." These technologies are therefore the key to a qualitatively new stage of production and to an above-average rate of increase in labor productivity. This, in turn, determines "how our economy meets the needs of the people and the multiple internal requirements for the development of our country and how it can hold its own in the world." So we cannot choose our own pace. That is the reason for the call to win the race with time, to take the lead in important areas, and thus to achieve substantial economic and social results.

The party and government provided timely orientation toward the latest scientific and technical developments. Science and production became more closely linked in recent years, which saved our national economy an average of 500 million hours of labor time annually. Thus we are well-equipped to meet the challenges of the scientific-technical revolution. Most of the flexible automated production systems that the working people have created in honor of the 11th SED Congress, for example, are peak performance internationally. They underscore the fact that in important sectors the GDR has kept up with the increased pace and has itself achieved top positions. In 1970, for example, we did not have a single industrial robot, whereas there are now already 60,000. Today 53 percent of the fixed assets in industry are automated.

Despite everything else, man remains the main productive force. In socialism, he organizes that clearly higher economic result not for others but creates it for himself. Socialist production relations with the combines as the backbone of the planned economy offer favorable conditions for this and are being improved in the majority of working and living conditions. Extensive measures in training and advanced training are aimed at making more efficient use of key technologies.

"In socialism, microelectronically controlled machines and the mass use of robots truly allow the individual to be the master of production, the sovereign of technology," stressed Erich Honecker at the 11th SED Congress. With the key technologies, we open up almost unlimited performance reserves for further economic and social progress. Their efficient use is an important basis for achieving a national income of more than 1.3 trillion marks in the years 1986 through 1990. From this national economic result, in turn, flow the resources for the realization of the unity of economic and social policy. In this way, we master the scientific-technical revolution without unemployment and show that only socialism is able to produce a modern production structure without new poverty as in the capitalist countries.

#### Key Technologies for Dynamic Increase in Output

Such key technologies as microelectronics, up-to-date computer technology, and CAD/CAM hold an important position in the economic strategy with a view to the year 2000 as decided by the 11th SED Congress. More and more, they determine the productive capacity of the national economy. Other key technologies such as modern biotechnology and materials technology as well as automated machining and processing technologies are being applied in close interaction

with them. With their help, it is possible to make production more efficient and more rational. At the same time, the working people are thereby establishing favorable preconditions for interesting work requiring creativity as well as for a less wasteful use of natural resources.

Decisive improvements in the economy and thus in our life as well depend precisely upon the key technologies based on fundamental discoveries in physics, chemistry, mathematics, 20th-century biology and other scientific areas, whose "development" demands the full commitment of research teams, engineers, foremen and workers.

Key technologies are the heart and the motor of socialist intensification. In the area of microelectronics, the spirit of research in science and production in the combines and scientific installations of the GDR has so far led to 17 efficient base technologies and to a considerably larger number of applied technologies. In combination with other research results, they are a sound basis for intensification. Microprocessors, microoperators, microsensors and new materials, robotics, laser, electron-beam and plasma technologies are in many cases the point of departure determining the technological level for important innovations.

With the key technologies in particular, the material base is established for making comprehensive intensification--now the determinant source of our economic development--permanent. The irrevocable goal is to make a noticeable improvement in the level of quality and efficiency throughout the national economy through peak scientific-technical performance. That makes clear the contribution that scientists and technicians must make to the increase in socially necessary new dimensions and quality by turning scientific-technical achievements into economic effects more quickly and more extensively than before. The scientific manner of process control and procedure design presents completely new opportunities for a substantial increase in labor productivity, for a lowering of input, and for the refinement and renovation of production and promotes the intended structural changes in the national economy in connection with the scientific-technical revolution.

Key technologies generally work to save energy, material, labor time and jobs simultaneously. With their help, the material and technical conditions are revolutionized and an above-average gain is achieved for the society as a whole. When, for example, the five-year plan directive of the 11th SED Congress provides for increasing labor productivity on the net-production basis in the area of the industrial ministries from 149 to 151 percent, for saving 2.5 to 3 billion man-hours, and for putting 15,000 to 16,000 new products into production, then these tremendous challenges can be handled only with confidently controlled and harmonically interwoven key technologies.

The shift of our growth-oriented national economy to key technologies is in full swing. That extends from the preparation of raw and other materials and the conversion of primary energy to the development of the profile of electrical engineering and electronics and of machine building, which is pioneering in accelerating scientific-technical progress. The results are visible and measurable in, among other things, the manufacture of microelectronic and optoelectronic components, in the use of up-to-date

computer technology, in the computer-aided planning, design and control of production, in the use of flexible automated production systems, in refining metallurgy and nuclear energetics, and in numerous high-refining chemical processes.

Key technologies are also having a greater and greater effect in such areas as intellectual and cultural life, health care and free time. The "creation of true wealth," as Marx said, actually depends "upon the general state of science and technological progress." More than ever, entirely in this sense, science and technology are determining the dynamic increase in national economic output and the wealth of the material and cultural life of the people in socialism.

#### How Do Key Technologies Produce the Greatest Effects?

The 11th SED Congress analyzed the results achieved with the economic strategy and noted that success was achieved in making the change to comprehensive intensification and in introducing a far-reaching renewal process in production. In important sectors, the GDR has kept up with the increased international pace of the scientific-technical revolution and has itself achieved top-level positions.

Peak efficiency thereby serves the well-being of the people and the securing of peace and builds on the capabilities of the working people to make the best-possible use of up-to-date technologies in their own interest. The socialist planned economy makes it possible to put modern technology and above all the key technologies to work for the unity of economic and social policy.

The crucial question is in employing key technologies so that overall a higher rate of increase of labor productivity is attained. This was achieved in an outstanding manner in recent years with the establishment of automated production sectors, among other things for the manufacture of components for machine tools, gear boxes or mower blades. In the parent enterprise of the VEB Tool Combine Schmalkalden, for example, the production of mower blades was automated from cutting to size to packaging. Productivity rose to 350 percent and heavy, dirty and monotonous work was eliminated for 141 workers. In the meantime, 112 workers have taken up other important work in the enterprise.

With a view to the year 2000 and especially in the interest of the greatest efficiency, of importance is a new stage in the organic alliance of science and production, at the center of which are the combines. The result will be new technological solutions that accelerate the growth of national income at the same time that the specific productive consumption declines. What is needed thereby is for each combine to make its own contribution.

The Zeiss workers showed the way. With their 1985 results, they established important preconditions for the production of the 1-megabit memory. It will thus be possible to realize 1 million memory functions in an area the size of a small fingernail. In the 1960's, just one such function could be accommodated in this area. A technological precondition for the 1-megabit memory is, for example, the electron-beam exposure machine ZBA 20. It is employed in the production of semiconductor slices with the highest

integration level, which are an important basis for future microelectronic circuits. The device is of benefit in particular to the microelectronics manufacturers in the GDR and the USSR. With the preparation of the next generation of equipment, to which a 4-megabit memory belongs, the Zeiss workers are taking into account the requirements of the components industry in the early 1990's at an advanced level.

The Zeiss example represents a peak performance in microelectronics, which is of great importance to the national economy. Such results are needed in many areas. In combination with other key technologies, the preconditions are thereby established to achieve the rate of increase in productivity required by the 11th SED Congress. That, in turn, enables us hold our own in the world and to continue successfully the unity of economic and social policy in the future as well.

This trend is decisively influenced by the ability of the people to control key technologies in their own interests in the best possible manner. For this purpose, our uniform socialist education system is being improved and a solid base is being established in the schools, instruction and studies. From the viewpoint of general education, for example, questions in electronics, microelectronics, data electronics, and automation have recently been included in the curricula at the polytechnical secondary schools. The situation is similar in university studies, vocational training and advanced training.

#### What Are Focal Points of Scientific-Technical Cooperation in CEMA Complex Program in Key Technology Area?

The long-range goals of the CEMA comprehensive program put high demands on the development pace in science and technology of the CEMA member countries, especially in the area of the key technologies. That is also a determining criterion for the shaping of the research cooperation with the USSR. A growing contribution to the development of the productive capacity of our national economy must be achieved through a coordinated and uniform approach, the systematic division of labor, and the development of production and reciprocal deliveries of up-to-date equipment as well as through a broad exchange of experiences and results to mutual advantage. That makes it possible for all those involved to make substantial gains in efficiency and quality. Thus key technologies are to make an important contribution to doubling labor productivity by the year 2000 and to reducing the specific production input decisively.

Of special importance for the GDR is the goal of developing the uniform base of electronic components with new generations of large-scale and maximum-scale integrated circuits, of expanding the range of computer science--including personal computers--and of making broad application of digital data transmission and optical fiber technology. In addition, the GDR will do more to develop and produce technologies and special equipment and will produce efficient components to greater advantage. In this way, a higher level is to be achieved as soon as possible in the application of CAD/CAM, in communications, in the construction of scientific equipment, and in technical consumer goods.

International cooperation in overall automation will effectively support our efforts in this area. The qualitatively new step is flexible automation in entire production sectors, including the preparation of production and assembly, automated quality control, and transport and storage processes. The joint work also concentrates on the creation of new types of efficient industrial robots with sensor technology.

Numerous activities are aimed at producing more with about the same use of raw materials. Taking into account the increasing demands on the economical utilization of organic fuels and on environmental protection, nuclear energetics is being developed as the main direction for covering the future increase in the demand for electric energy and heat. At the heart of the diverse research and development work is the full guarantee and increase in the nuclear safety of the nuclear energy installations. It is thereby especially a matter of the further development of the equipment and systems as well as of the improvement of the scientific management and technologies for maintenance and reconstruction.

Greater efficiency is also the focus of the use of new materials and technologies as well as of their production and processing. For this purpose, such tasks as the production of new ceramic materials for microelectronics, motor building or for catalysts were stipulated with the USSR. The projects also aim at the production of microcrystalline and amorphous metals, powder metallurgical products, high-purity materials and plastics and elastomers.

For continued progress in important areas, much depends upon the scientific-technical work in the area of biotechnology. This work is linked, among other things, with the goal of organizing agricultural production more efficiently, of developing and introducing high-quality materials and special biochemical products, and of making better use of available raw materials. The comprehensive program is therefore oriented toward gaining control of and applying the new basic methods of gene, enzyme, cell and immune technology in the biotechnological laboratories quickly and extensively.

Greater creativity of scientists, technicians, engineers and specialists and the great efforts of each CEMA member country are necessary to master key technologies jointly more and more quickly and to achieve and consolidate a high level of technological performance. As Erich Honecker explained at the second session of the SED Central Committee, the GDR sees an important way in the development of direct relations between scientific installations, enterprises and associations on an economic basis. It is a matter not only of reaching the top international level in selected areas sooner than has been foreseen heretofore but of staying a step ahead of it. A large annual increase in output and the rapid renovation of production are just as much a part of it as the command of a growing assortment of products and flexible reaction to technical innovations as well.

To ensure the necessary pace, strategic goals and stages for the creation of new products, procedures and technologies were established in more than 90 subject complexes. In the GDR, the tasks for the realization of the comprehensive program are part of the state plan for science and technology. More than 700 state plan tasks are currently aimed at the focal points of the

program. The point of departure thereby is always the fact that the further strengthening of socialism and thus the securing of the peace depends more than ever upon the capability of socialism to develop substantially the dynamics of the productive forces by utilizing all of its advantages.

#### What Are the Effects of Microelectronics?

Microelectronics is the main source for the acceleration of scientific-technical progress and, together with up-to-date computer technology and CAD/CAM, is increasingly determining the productive capacity of a national economy. It provides important impulses for an above-average increase in productivity and improved working and living conditions.

In keeping with its broad effects, the dominant role of microelectronics will become more pronounced, states the five-year plan directive of the 11th SED Congress. The existing assortment of circuits is to be expanded by 1990. The annual production of active components increases by more than 26 percent and that of passive components by 12 percent. The researchers are looking at, among other things, optoelectronic components for sensor technology and optical fiber transmission, display color picture tubes, and surface-mountable components.

Microelectronics permeates the entire national economy and increasingly characterizes the level of the most varied products and procedures--those of controls, robots and computer technology, for instance. People alone determine to what extent it can do that. They work out the appropriate programs for machines and can utilize microelectronics in combination with up-to-date computer science more quickly and more efficiently to find optimum variants. The new spur-gear revolving grinder from the VEB Machine Tool Combine "7 October," for example, is characterized by an electronic drive. It replaces 1,050 structural parts per machine from a half ton of steel and saves 400 production hours. Here microelectronics leads not only to a substantially more favorable mass-output ratio but also saves the user a great deal of time, energy and costs.

This trend is characterizing machine building in the GDR to an increasing degree. Thus the production of metal-cutting machine tools with microelectronic equipment increased from 11 percent in 1981 to 72 percent in 1985. The basis for these innovations was, among other things, an accelerated manufacture of active electronic semiconductor components, which has increased by 385 percent since 1980. It was even 630 percent in the case of monolithically integrated circuits.. At the present time, the GDR effectively controls 17 base technologies of microelectronics in production. The assortment of active components was increased considerably since 1980 and now includes 612 basic types. Thus the GDR is among the few industrial countries that develop, produce and apply microelectronics.

All these are important bases for using the key microelectronics to bring about effects in the entire national economy that were absolutely unthinkable through traditional ways. How else could more and more combines achieve rates of increase in productivity of 10 percent and more year after year? This pace, in turn, is crucial in determining how the economy meets the needs of the people and requirements of the GDR. Representative of this is, for example, the fully automated cup-production line at the VEB Porcellan Works in Koenitz. With its help, the annual number of pieces is increasing by a factor of nine and porcellan workers now handle production from the control console.

With the help of microelectronics, it has for the first time been possible to automate the acquisition, transmission and processing of information and thus to establish a critical precondition for fully automated production. The 11th SED Congress set the task of tripling the share of automatically manufactured products in the GDR by 1990. The comprehensive application of microelectronics is at the heart of these radical changes, especially in the case of flexible automation. Such a processing complex with computer-aided control and the use of industrial robots made it possible at the VEB Metal

Foundry in Wernigerode to organize the scouring of cast parts so as reduce substantially noise, dust and heavy physical labor. At the same time, industrial commodity production increases by 1.4 million marks and 100 kilowatt-hours less electric power is needed for the scouring of each ton of casting.

When in Wernigerode 6 workers are now needed instead of 16 to create these effects and 10 are working at other focal points of action in the enterprise, then that makes clear the influence of the key technologies on the work capacity, that is, on the work of each individual. Microelectronics changes the content of work and challenges the people.

Only someone who considers this fact and draws the conclusion that everything possible must be done to master the new technologies can fully develop their potential for the organization of our present and future. And that has long since been valid not only for some specialists but permeates entire industrial branches. At the VEB Paul Schaefer Shoe Factory in Erfurt, our republic's largest producer of women's shoes, for example, the computer-aided design of shoes is no longer a vision of the future. Microelectronics and up-to-date computer technology as well as CAD/CAM are being put to work for people.

It is apparent that microelectronics molds fundamental progress in many areas of life, especially work. At the same time, it has more and more of an influence on the organization of leisure time. In the case of technical consumer goods, for example, microelectronics contributes to high quality and reliability as well as to an overall increase in supply. It makes possible time saving in the household--through efficient kitchen equipment or microelectronically controlled washing machines, for example. We encounter it in the most varied hobbies and in teams for amateur radio operators, model flying or computer science. Modern color-picture tubes refer to the introduction of microelectronics into the area of entertainment electronics, in which much is still expected in the future.

#### Wherein Lies the Great Value of CAD/CAM?

CAD/CAM, the computer-aided preparation and control of production, is occupying more and more of a key position in our national economy. Erich Honecker stressed as the 11th SED Congress: "We expect from the economical utilization of this modern technology a greater efficiency in the work of design engineers, project planning offices, designers and technicians as well as a more flexible and efficient organization of the entire work process."

Heretofore, for example, the design engineer had to operate with a pencil, drawing board, slide rule or pocket calculator and numerous reference books. The result, with a great deal of effort, was drawings and lists, the bases for all further work steps up to production. Through the use of CAD/CAM technology, the design engineer carries on a dialogue with the computer through the monitor and also makes use of other input and output equipment such as automatic graphic units. Thus the work tasks change for many workers. This up-to-date design (CAD) establishes the basis for the automated general process organization including the computer-aided control of

production (CAM). In addition to a gain of time, there is a greater ability to react to changes in current production and thus to customer wishes as well.

At the VEB Vegro Kirschau, Loebau Works, for example, blankets have been made for many years but in a completely new way for several weeks now--with computer-aided automatic looms. Electronic studio work has begun. CAD/CAM now creates the patterns of the products in 2 days and likewise determines the most favorable color variants. Previously it was all manual work that required 6 weeks. Overall productivity in the manufacturing increased by half and a substantially renewed commodity assortment and more flexibility in the production make possible economic effects. The nature of the work also changed. The engineers, for example, no longer have to burden themselves with so much but have more time for new ideas, with which they then "feed" technology.

Results in microelectronics made possible the large-scale economical use of CAD/CAM. Large-scale integrated circuits and memory circuits are indispensable to utilize efficient electronic computer units in large numbers with a justifiable economic outlay at the immediate workplace or to put into effect technical solutions from the workplace with the help of centrally located computers. The dialogue with the computer thereby becomes the decisive characteristic of a new quality in the application of computer technology.

Relevant experience confirms that in this way productivity can be increased by 100 to 500 percent for design engineers, project drawing offices and technologists as well as in the areas of planning and administration, accounting and statistics. As a rule, material savings of 15 percent and more are possible through more thorough calculations and investigations of variants and warehousing also becomes substantially more efficient.

It is very important that with the application of this key technology the time for the development and mass production of new products can be reduced by 30 percent and more and thus a vital means is available for the substantial acceleration of the renewal process. With the help of CAD/CAM, the design engineers at the combine VEB Carl Zeiss JENA have substantially accelerated the work process in high-performance optics and achieved high specific use characteristics. They prepare drafts on the viewing screen and computers provide all the necessary data for this. With the help of the computer, they utilize experimental values and new scientific-technical knowledge. They then optimize their drafts in dialogue with the equipment. In this manner, extensive and complicated calculations are made substantially more quickly than before.

In this way, the workers completed new developments in 3 to 4 months instead of in a year as before. And more than that: this key technology allowed projects to become reality that would not have been possible at all with conventional methods but projects that we need if we are to produce first-class products.

In recent months, the number of CAD/CAM work stations in the GDR was approximately doubled, so that there are now more than 16,000. The pace will be further accelerated. Whereas the 1986 plan was originally based on another

2,500 such stations, it will now be over 15,000 new stations. At the end of the year, then, 100,000 workers can already be utilizing CAD/CAM stations in their work.

Overall, then, substantial effects result. With the use of 85,000 to 90,000 CAD/CAM work stations by 1990, the work of about 500,000 workers will be several times more productive and their work will undergo a fundamental qualitative change. Creative activities in all combines continue this trend and thereby link the technological change with social effects.

Commitment is important to make effective use of the new latitude for creativity in the interest of the main task. In any case, thorough training is just as necessary as extensive preparation. The effects result not from the existence of modern technology but from the mastery of the possibilities offered by this technology.

#### What Possibilities Are Opened Up Through Biotechnology?

People have used biotechnics more or less consciously for hundreds of years. A completely new phase began in the mid-1970's with the clarification of the genetic mechanism. The object of modern biotechnology is to research biological processes, influence them purposefully, and utilize them for production. With their help, highly productive microbes can be bred and put into mass production--the production of fodder protein, enzymes and antibiotics, for example.

This sudden change in quality is a function of the development of gene technology, cell technology, immune technology and enzyme technology. In the GDR, the production of important biotechnological products increased substantially in the last 5 years--by 38 percent in the case of fodder yeast and by 60 percent for enzymes. That operates in several areas.

At the Research Center for Soil Fertility in Muencheberg, together with the Research Center for Biotechnology in Berlin, it was possible to develop bacterial compounds in which the fixation of atmospheric nitrogen in the soil increases, thus permitting 7 percent higher yields in the cultivation of alfalfa, for example.

With biotechnology, it is possible to push refinement and to make rational use of regenerable resources. It improves the provision of high-quality feedstuffs, medicaments and foodstuffs and, together with energy-saving and no-waste technologies, reduces the load on the environment. At the same time, it contributes effectively to productive animal stocks and high-yield plant varieties.

Today modern biotechnology is closely linked with the application of microelectronics and the automation and process technology based upon it. In the mid-1980's in the GDR, research and production in the area of biotechnology were accelerated with the goal of tripling the production of such products by 1990 relative to 1985. This key technology is thus becoming a critical force in the chemical industry for the high refinement of starting

materials, for example, and opens up broad possibilities for the national economy as a whole.

An example of this is, among other things, the production of fodder protein for animal nourishment from crude oil distillates at the VEB Petrochemical Combine in Schwedt, in the very first large-scale industrial facility of this kind in the world. Yeast cultures are thereby used in 2,200-cubic meter bioreactors. Here is seen the revolutionary element of biotechnology: the synthesis of the latest results from the life sciences and the technical microbiology.

Biotechnology is becoming more and more important for the modernization and intensification of production. Through the effective use of existing and the building up of new capacities, in the coming years it will be a matter of producing considerably more fodder protein, lysine (a concentrated feed supplement), antibiotics, diagnostic materials, and enzymes. The agenda includes the intensification and expansion of the production of biotechnological products through the introduction of genetically influenced high-performance stocks in combination with computer-aided procedures. New substances are likewise needed for our human and veterinary medicine.

The latest example is a special human interferon developed through purposeful technical gene engineering and created in close cooperation between the Central Institute for Microbiology and Experimental Therapy of the Academy of Sciences of the GDR and the VEB Pharmaceutical Combine GERMED. This highly effective medicine against a number of viral diseases has the biotechnologists to thank for its very rapid development in international terms.

In the coming years, as decided by the 11th SED Congress, the accelerated development of biotechnological production must be accompanied by a molding of the capacities for up-to-date equipment and facilities including research equipment as well as for the appropriate chemicals. The goal is to be effective in solving such central questions of intensification in the materials-conversion industry as higher productivity, high-refinement, and the economical use of raw materials and energy and thus to make a noticeable contribution to the realization of the unity of economic and social policy.

#### What Are Advantages of Up-to-Date Processing, Manufacturing Technologies?

The greatly increased labor productivity of recent years, the results in material and energy savings, and the reduced manufacturing times of many products received substantial support through the development and application of up-to-date processing and manufacturing technologies. In the first half of 1986 in the GDR, additional capacities went into operation for the application of progressive processing and manufacturing procedures--as for steel wire rope and polyamide silk.

The 11th SED Congress set the task of implementing the automation and broad application of energy and material-saving processing methods as a unit. Of increasing importance thereby because of their efficiency are such progressive technologies as cold or warm extrusion or fine casting. In powder metallurgy,

workpieces for electrical engineering, electronics, vehicle construction and machine building are produced with practically no waste.

Of special importance for the output trend of the combines is a rapid expansion of electrophysical processing methods on the basis of laser technology, electron and plasma-beam technology and vacuum technologies. In this process, with the use of electron beams for the hardening of metal in the parent enterprise of the VEB Fritz Heckert Machine Tool Combine, productivity increases by a factor of almost 10 while the expenditure of energy declines by 80 percent and there is practically no longer any loss of energy. In the quality of processing, they achieved top values internationally in Karl-Marx-Stadt.

With the vacuum-melting method by means of electron beam and plasma beam, our republic has effective technologies for the molten purification of steel and nonferrous metals. The set-up and testing of the solid-matter converter at the VEB Maxhuette in Unterwellenborn are another way of going beyond what is known and thus of finding the most efficient solutions in the interest of the GDR. The new method achieves more than 30 times the output relative to the Siemens-Martin furnace by combining the advantages of a converter with the possibility of using exclusively scrap metal as raw material.

Laser technology occupies a key position in the processing of materials--as in the separation, boring and welding as well as in the hardening and engraving of material. Production engineering thereby makes use of this method in the rational and very precise processing of metals, plastics, glass, wood and other materials.

The quality, wear resistance and good appearance of products are largely determined by their surfaces. Many products cannot even be produced economically without the application of special surface techniques. Such procedures have a substantial influence on the microelectronics and computer science as well as on machine building and energy technology.

Of fundamental importance are the vacuum-metallization method for the refinement of metals, the metallization of plastmaterials or glass, and the coating procedures by means of atomization. With the vacuum metallization of aluminum to strip steel, more than half of the packing plate needed annually in the GDR is effectively protected against corrosion. The vacuum coating, in which, for example, scientists of the Manfred von Ardenne Research Institute as well as the Central Institute for Solid-State Physics and Materials Research of the Academy of Sciences of the GDR have distinguished themselves, has attained enormous importance for microelectronics, is in many cases replacing precious metals, and meanwhile has also been introduced in the GDR for the manufacture of mirrors for the population.

There are other up-to-date processing methods that arise above all in close interaction with the development and production of new materials and materials combinations. With full justification, therefore, the entire complex of modern processing and manufacturing technologies is characterized as a key technology. The progress of the technology and production engineering is thereby linked directly with the saving of process stages, material and

energy economy, improved quality, and functional reliability--important preconditions, then, for flexible automation.

Besides up-to-date processing nad manufacturing technologies, it is also a matter of an analogous way of assembly, especially in medium and large-scale production. A few weeks ago, for example, the workers of the VEB Sheet Forming Plant in Leipzig put into operation a production section requiring few operators for the assembly of the supplementary muffler for the Trabant passenger car. The builders of the means of rationalization played a significant part in this. The production time declines by just under half to 3 minutes and heavy labor was reduced for 36 workers.

#### What Is Effect of New Materials?

To a large degree, key technologies are linked with such new materials as high-quality glass, special plastics or polymers. The 11th SED Congress emphasized the value of new materials for the economic strategy and set the task of developing and above all of making broad economic use of top-level positions that have already been achieved, as in the case of the individual glass and ceramic materials. Microelectronics requires extremely pure materials and new ceramics and plasts, for example. But microelectronic controls are also a precondition for the production of new and advanced materials and semifinished products.

Up-to-date materials open up new possibilities and often fundamentally new ways for a substantial improvement of the use characteristics, quality and reliability of the products as well as for a lower expenditure of material, energy and labor. A transition to completely new product generations on the basis of new functional or working principles is often possible, whereby materials are increasingly usable on a domestic basis.

An example of this is optical fiber transmission on the basis of optoelectronics and extremely pure glass materials. With their help, it is possible to transmit considerably more information in better quality free of interference and with little loss. Thirty grams of delicate glass fiber handle the same quantity of information as 340 kilograms of copper cable heretofore. With 1 kilometer of optical fiber cable, it is possible to save more than 1.6 tons of copper, over 300 kilograms of lead and 720 kilograms of polyethylene.

Within the scope of the initiatives for the 11th SED Congress, a production site was put into operation at the VEB Carl Zeiss Combine JENA for the production of extremely pure semifinished glass products for optical fiber technology. The additional quantity of semifinished glass products that will be produced there above the state target in 1986 makes possible the manufacture of about 4,000 core kilometers more of optical fiber cable for the transmission of information.

In construction and machine building as well, high-quality glass materials lead to novel solutions and save rolled steel, for example. Thus in 1985, glass tubing from the high-quality "Rasotherm" borosilicate glass was installed instead of steel pipes in more than 45,000 dwellings. In this way,

not only is the use of steel reduced by about 16 kilograms per dwelling but the hot-water lines are also considerably more durable and reconstruction costs are lower. That benefits everyone.

New design possibilities and the use of other materials such as molded plastics make possible so-called glass-ceramic materials. Meanwhile, the production of ilmavit--manufactured with domestic raw materials--has begun. Noncorrosive, machine-processable and resistant against wear--those are only a few of the effects of this glass ceramics of benefit to the national economy. By 1990, according to the five-year plan directive of the 11th SED Congress, it is necessary to prepare the production and application of new ceramic materials and put into operation a capacity for 1,000 tons of ilmavit.

Materials made to order are also indispensable for high refinement in chemistry and also influence other key technologies. Photocopier resists, for example, are used in designing circuit structures for microelectronic components. The highest purity requirements have been put on trichlorsilane, the starting point for the production of the highest grade of silica. This substance is produced at the VEB Chemical Works in Nuenchritz, whereby a ton of trichlorsilane is allowed to have at most 1 milligram of impurities.

A close and specialized cooperation of producers and users as well as research installations is vitally necessary to be able to make new and advanced materials fully usable. In this connection, the Dresden Information Center for Materials and the Economical Use of Materials of the Institute for Light Construction and the Economical Application of Materials supports the combines and enterprises, imparts knowledge on new material qualities, give advice on the use of materials, and increasingly also makes materials-information memories available for CAD/CAM solutions.

#### Why More and More Closed Material Cycles

The dynamic development of the national economy of the GDR is fully oriented toward growth and toward a more and more favorable relationship between expenditures and results. The protection of the natural environment is inseparably linked with this. More and more, technologies are being used that make possible a recovery of materials and their reuse in the economic cycle. It is necessary, stressed Erich Honecker at the 11th SED Congress, to organize the use of energy, raw materials and other materials in the national economy as economically as possible. The waste products must flow back into it, for they are an important domestic source of raw materials that would otherwise be lost to us and put stress on the environment as dumps, sewage and waste gases. In our republic, this cycle has so far been successful above all in the case of scrap glass, waste paper and used oil.

Special intensification effects arise from the organization of closed material cycles, the most efficient way of making full use of the raw materials employed. An increase in output with no additional utilization of natural resources is considered a measure of the capacity of the science and technology of a country.

In the last 5 years in our republic, for example, we have been successful in increasing the yield of so-called light-colored products substantially through the deeper cracking of petroleum--from 15 to almost 75 percent at the VEB LEUNA-WERKE Walter Ulbricht Combine, for example. The Leuna workers will further improve the technology this year and increase the yield to 79 percent. They process the rest into 650,000 tons of methanol annually. At the same time, the chemical workers are obtaining more than 20,000 tons of sulfur annually as an important raw material for organic synthetics. In this way, they achieve the complete material utilization of the petroleum as highly-refined products in the internationally first operation of the facilities without heating oil.

The GDR is relying increasingly on low-waste and wasteless technologies in industry and agriculture as well as on the maximum use of wastes. For this purpose, important tasks have been set that show the dimensions: the usable secondary energy is to be almost completed utilized by 1990. It is currently utilized at 88 percent. By 1990, the share of secondary raw materials in our raw materials base, which amounted to 30 million tons in 1985, is to increase by another 5 to 6 million tons.

In the future, even more consideration must be given to the previous experiences and knowledge even in renewal. It is decided as early as the development phase whether and in what scope wastes arise and how they can be reused efficiently so as to form closed material cycles. That is also true for the increasing utilization of waste paper and for the obtaining of precious metals, which would otherwise have to be imported, from electronic scrap and other raw materials. Today one can already characterize a whole series of processes as wasteless. An example is forming in metalworking without cutting instead of the cutting production processes.

Other key technologies are also opening up new possibilities and ways to reduce the use of primary raw materials and to avoid waste products. Among them are the economical effects of the use of microelectronics, new materials or biotechnological methods.

#### How Has Science Adapted to Key Technologies?

Today and even more so in the future, key technologies will be the result of profound scientific work. They are without exception based upon scientific discoveries and basic inventions. Evidence of this is the development and application of microelectronics, for example. It is not enough, however, to discover or invent the basic principle. To achieve operational and highly productive technologies in the necessary complexity and to use them efficiently, above all purposeful basic research, applied research and development, and an efficient scientific and technical environment are needed.

Quite without doubt, today's key technologies will be further developed and new ones will arise in the coming years. The history of science and technology shows that. It allows the conclusion that today about 80 percent of the discoveries and inventions have already been made that will be used in production as innovations in the next 20 years.

We cannot forego the application of any key technologies in the national economy, nor, to a certain extent, without their scientific-technical elaboration. Intensive full-scale research cannot, however, be handled in the GDR but only in the close specialized cooperation of the researchers of all socialist countries on the basis of the comprehensive program for the scientific-technical progress of the CEMA countries.

To that end, it is necessary to develop the store of knowledge of basic research purposefully for the increased output of the national economy and to concentrate basic research itself on the focal points and main directions of the currently discernible scientific areas and key technologies of most importance for the national economy.

In the case of key technologies, it is more than ever a matter of achieving a faster pace and more efficiency. It is necessary to recognize and make use of opportunities and to prepare and master sectors of the cycle science-technology-production-sales in their internal context. As was stated at the 11th SED Congress, the 10th Session of the Central Committee last year made some far-reaching decisions for the further organization of the cooperation between scientific installations and the combines. The basic thought is to achieve the highest performance in science and technology, which originates in long-range basic research and leads to high economic and social effects as soon as possible.

New is above all the fact that the purposeful basic research of the combines, academy installations, universities and colleges already aimed at specific products, methods and technologies is contractually stipulated and that research as well as the rapid and productive utilization of its results are strongly stimulated by the corresponding economic provisions. It continues to be a matter of more cooperation in the forecasting and conceptual work in preparing for strategic decisions for the development of the combines and in the material and technical guaranteeing of scientific work through the efficient use of the capacities and physical resources of the partners.

All of that expresses a new quality in the cooperation that takes into account the objectively mature interaction between science and production. That is why, for example, 62 coordination agreements were entered into in recent months between combines and the Academy of Sciences of the GDR, agreements that so far have led to almost 600 general service contracts with specific binding tasks. The cooperation of the academy is organized with such combines, for example, as microelectronics, Carl Zeiss JENA, "Walter Ulbricht" LEUNA-WERKE or automation-systems construction. It is aimed at performance determining world levels, including the development of large-scale integrated memories, the development of new components for the transmission of information with beam waveguides, and the elaboration of the bases for prospective automation systems.

The first experiences already indicate that the specific objectives in the general service contracts determine above all the level, degree of newness and national economic efficiency of the performance aimed at in the research cooperation.

## Key Technologies--Challenge to Man's Creativity

The report of the SED Central Committee to the 11th SED Congress states in regard to our economic strategy with a view to the year 2000: "An economy whose force is based increasingly on the capability of its people to master up-to-date technologies needs a creative climate in all social life if it is to prosper." That is especially true for key technologies. Their development and application is inseparably linked with their own ideas and capabilities; the individual becomes more and more the creative doer and organizer of production. That is why timely and good preparation is important not only for skilled workers, technologists, researchers and engineers but also for apprentices and graduates. Young people in particular have accepted the challenge of the scientific-technical revolution.

The Second Session of the SED Central Committee underscored the fact that we are mastering the scientific-technical revolution without unemployment and are showing that only socialism can bring about a modern production structure without "new poverty." The individual thereby truly becomes the master of technology. Hard and software, chips, computers, memories and display screens are all conceived and realized by working people in a creative process.

Diverse demands on education and advanced training derive from the progress of modern productive forces, for in part completely new demands are being put on the knowledge and skills of the working people. Our education system is therefore being improved to form a solid base in school, apprenticeship and study.

Key technologies act in their complexity. For one thing, they are closely interwoven with one another. For another thing, they are characterized by an extremely broad application in industry, agriculture and construction as well as in the health service system, in public education--in short, in all social areas. That sets high standards for the creativity of almost all working people in making an active contribution to the development and application of new technology. That affects the level as well as the extent and pace in which it takes effect. Under socialist production relations, this challenge also promotes the further expression of the creativity of the people. It is an unlimited reserve for increasing the productivity and efficiency of labor.

The knowledge of the overall social importance of key technologies as well as the experience, knowledge and skills of the working people represent an essential basis for creativity. Diverse activities in the work collectives, with the help of the trade union, and through the action of the Chamber of Technology, the URANIA and many other groups were and are aimed at this. Thus, in the scope of the "Chamber of Technology Initiative 11th SED Congress," 95,000 researchers, developers and innovators took part in courses of study and 100,000 participated in technical conferences. One-third of them received advanced training in an ample year in the area of key technologies.

In the territories, scientific and production teams support the use of key technologies, especially microelectronics, precisely in small and medium-sized enterprises as well. Every enterprise has its specialists but not in all areas. Here only the community leads to an efficient collective. In

Haldensleben District, this manner of cooperation of individual design engineers, project drawing offices, microelectronics engineers and other specialists from different enterprises offers favorable conditions that successfully and very efficiently solve tasks demanding creativity.

Such an approach promotes the willingness and competence to make effective use of key technologies as a means to mold the unity of economic and social policy. For this purpose, it is worthwhile to employ more creative power. For the faster and more comprehensively key technologies are used consistently and highly efficiently, the better we can fulfill the main task and the more quickly the quality of life in socialism will improve.

#### Why Are Key Technologies Important for Everyone?

The improvement of the material and cultural standard of living of the citizens of the GDR requires strong and constant economic growth. The economic strategic of the 11th SED Congress with a view to the year 2000 is therefore "tailored to a continuous and dynamic rise in output." This growth, according to the party congress, will be influenced more and more by the interrelationships between the economy and the various social areas, including the organization of leisure time and services in the broadest sense.

More and more people are preparing the use of key technologies and are working with them. At the same time, the number of those who in effect consume the results, whether at work or at home, is growing continuously. None of that comes by itself but only from the working people themselves. The areas for the application of key technologies must truly be developed. The rapid development of the productive forces does not stop for any enterprise, no matter how small it may be. For example: whereas the first stage of electronic data processing about 15 years ago affected most people only indirectly, today and in the future more and more workers will want to make the computer their personal work tool. And that is equivalent to going from being a passenger in a car to driving it.

That is linked with changes in the nature of the work. When heavy physical work in manufacturing is taken over by machines, it does not follow for us that the manpower thereby gained is not needed for our national economy. On the contrary, some of them take over the certainly more demanding control, monitoring and maintenance. Others will be needed in a completely new way in the construction of the means of rationalization or in the production of consumer goods.

Here it is apparent that in reality a society like ours can prosper only through conscious participation by all. That has consequences. Thus 1,000 CAD/CAM work stations put into operation last year saved our national economy 35 million man-hours. Meanwhile, there are already more than 16,000 such stations in operation. There will be a total of 85,000 to 90,000 by 1990. So the pace is being further accelerated and more and more people are involved in this development. At the end of this year, 100,000 workers will use such stations in their work and there will already be 5 times that many by 1990.

And that is just one of the key technologies that must be developed. Their utilization is on the agenda in many areas, often in combination with others. Whether in the secondary school, in apprenticeships, in studies or in advanced training, it is always a matter of promoting all creative capabilities and talents for the well-being of the society. In the meantime, questions of microelectronics, data electronics and automation have been included in the polytechnical training of the students. Beginning in 1986, new curricula are being introduced for each specialist job. Thus, starting in September, all apprentices will be acquainted with the fundamentals of automation in a new course.

These few examples are sufficient to show that key technologies are immediately affecting more and more people. At the same time, they have consequences even in everyday life--indeed, consciously and willingly. The more rational work of savings and other banks, insurance institutes, services and commerce has a direct favorable consequence for the citizens and the entire national economy. There is certainly hardly anyone who is not touched by progress in such areas achievable with key technologies. And to give just one more example here: with the help of conversational ticket machines in railroad stations or the gradual introduction of money cards in savings banks, the citizens gain more time for themselves--a small contribution to employing modern technology for the good of people.

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EAST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

GDR SCIENCE ACADEMY PRESIDENT DISCUSSES ACTIVITIES

East Berlin SPECTRUM in German No 6, 1986 pp II, III

[Interview by Joachim Moerke with Prof Werner Scheler, President of Academy of Sciences, date, place, occasion not given]

[Text] [Question] The Academy of Sciences was reopened ceremoniously on orders of the Soviet military administration of 1 July 1946 a few weeks after that date. Since then 40 years have passed. How would the founder of the Academy, Gottfried Wilhelm Leibniz feel if he saw his Academy today?

[Prof Scheler] The decision to reopen coincided with the 300th birthday of Leibniz; we see here a certain symbolism. 300 years after the birth of its founder the Academy experienced a rebirth--after spiritual decline and physical ruin by fascism, which drove a large number of outstanding scientists into exile or even exitus. Only in the seedbed of our progressive concept of society did the idea of the Leibniz Academy find its true fertile soil. To come to your question, though: It is always difficult to "rethink" thoughts of somebody else, especially of such an authority; does one not have enough difficulty with their interpretation? It was none less than Feuerbach who commented while studying Leibniz' philosophical ideas that this man could be easier misunderstood than any other philosopher because of the depth of his thoughts. I consider it therefore more useful to first locate and exploit all that which Leibniz has left behind, scientifically and philosophically. Much work has yet to be done here.

[Question] Asking more directly: Is the Leibniz concept of the Academy still meaningful for us?

[Prof Scheler] Without any question, because one thing is certain: the original plan of the founder of the Academy to combine theory and practice and to direct the sciences towards the general welfare of the people, has been brought to life in the past 40 years. It appears feasible and significant for the future, today more than ever before. The act of deliverance by the Soviet Army and the establishment of a power of workers and peasants with its center where Leibniz' Academy was and worked, in the center of Berlin, has opened up a space of social collaboration and co-responsibility for science in a manner unknown before. This is not astonishing, since the building of the new socialist order itself is based on scientific principles. That we make an effort to fill this space with outstanding results--be they new technology or theory, working material or life material, consultation or publication--has been demonstrated by the statement of our results at

the 11th Party Congress. Basically the Leibniz postulate is a program of work. It is tested and stimulated by higher demands and requirements at every step of our social development; at the same time it obtains more effective possibilities for its realization.

[Question] What are new elements in the development of the Academy since its reopening?

[Prof. Scheler] The transformation and augmentation of the old scientific society into a research oriented academy, which began that 1 July 1946, basically changed the social function and position of our Academy. What was denied to it for two and a half centuries, namely the operation of its own laboratories and institutes, was granted in our state in an exemplary manner. We have today over 50 central institutes and institutes with over 22,000 coworkers, which conduct research in the most important basic and many special disciplines of natural sciences, mathematics, engineering, medicine and social sciences.

I would like to mention that something very important favored the entry of our Academy in 1946 into the new development phase: the existence of a socialist research academy in the Soviet Union. We have learned from it and combined this model, which also contains Leibniz' thoughts, with the progressive achievements of German scientific organizations. The change and breakthrough which occurred here can also be seen from the fears of academicians like Th. Mommsen and A. Harnack, that the Academy would remain only "ornamental", or "decoration" if it could not find its place "in the center of life". This place it has truly found, as research academy of the socialist society, that unity of scientific society and research institution.

[Question] Both factors are still described in some publications as if the research academy has supplanted the scientific society?

[Prof. Scheler] This is a misapprehension. What would be the academy without its full and corresponding members? They represent the science of our country as its most respected representatives. The Academy is the forum and place of their communications. The monthly plenary sessions and the regular meetings of the specialized subgroups--incidentally every Thursday since 1711-- are a unique part of the Academy. From these discussions emanate strategic impulses for science, judgments are formed here, and mature decisions are formed which often are submitted as recommendations to the Party and to the Government. This clearly has also consequences for the work in the research institutes and provides feedback. This completes the circle.

[Question] You said that the Academy has found its place in society today. But it also must maintain that position...?

[Prof. Scheler] It must fight hard to regain its place through its achievements. Society's expectations of science are high, and justly so. This is why we pay such special attention to the link between science and practice. During the past years we have provided quite goal directed

coordination of the research areas, in cooperation with the universities, and have increasingly provided closer relationships between the combines and enterprises. This is especially valid since the 10th Plenary Session of our Party and it continues in the realization of the resolutions of the 11th Party Congress. We concentrate on those research areas, whose results can, if you will, be transferred as catalysts into the production of the combines.

Important for basic research is that it can draw on preliminary scientific ideas and that it can offer results with a technology orientation. For the combines it is important that they can build production strategies based on these considerations,--with the required production replacement rates, competitive products, high work productivity, and minimum material expenditures. We have, in cooperation with our partners, had a lot of activity here and we have learned a lot. At the time of this discussion we had newly developed and signed more than 60 coordination agreements and over 500 performance contracts with the economically most important combines.

[Question] Is there not the danger of "sellout" of basic research?

[Prof. Scheler] No, not at this order of magnitude--we link 45 percent of our potential with industry. We retain the necessary capacity for basic research. This can not be neglected because without one's own basic research one is unable to judge "what the others are doing". Safe prognoses cannot be made from literature searches alone. I once was asked whether basic research could be considered more a servant or a mother of production? It surely has something of both, but it would be false to estimate its capability to serve higher than its capability to produce.

[Question] Although it is more pleasant to know that one is in company of the tradition of Leibniz and other important scientists, it would be depressing if one could not enrich the annals of the Academy by equally significant contributions. And when one recites the big names, there arise...

[Prof. Scheler] I also think about that. Certainly, respect is good, but one must not become rigid in this connection. Tradition must be power not a burden; this is a matter of point of view, of one's own position. When our part of the history of the Academy will be written, and the past 40 years are an important part, significant achievements will also be recorded. I can imagine, for example, that the work of Academy members E. Rammler and G. Bilkenroth for the production of industrial coke from native brown coal would be comparable to efforts of an F.C.Achard, who has developed the technology of beet sugar. The important works of the romanist W. Krauss dealing with research on the enlightenment period in Europe can take their place next to the work of Ph. Boeckh and Th. Mommsen in exploring Greek and Latin sources. And it is no different in other areas. History will without doubt pass judgement on everything, but one can hope for a favorable decision only if one is firmly living in the present. Our tasks are here, and are given to us today.

Incidentally, to me, tradition is neither a mere reflection on the past, nor the wish for comprehension of an outstanding individual achievement, as much as we may need it. More important appears to me the continuation of the historical deed by our own deeds, with all the opportunities for self realization which are available today.

[Question] How does the Academy see itself on its way into the next century?

[Prof Scheler] It sees itself as a research institution which in the future must also provide impulses for the acceleration of scientific-technical progress. We will continue concentration on fundamental problems of key technologies in a division of labor in cooperation with the combines, not as a campaign, but a policy.

The 11th Party Congress has formulated tasks which reach way beyond the five year plan. It addresses, it appears to me, especially the younger generation of scientists, who will be the main contributors to research in the nineties.

Big tasks arise for our Academy in the collaboration with the USSR and in the framework of the complex program of the RGW (Council for Mutual Economic Assistance). This cooperation decides the destiny of the development of society. Here we must provide the best we can achieve. Present achievements in optoelectronics, laser technology, materials research, pyrolysis of carbohydrates, and controlled nuclear fission provide the start for what is required. One becomes capable for cooperation only through one's own high achievements, this will not change in the future either.

Science must be the "invigorating fire" which stimulates the continuing struggle of man with nature. This contains a Prothean thought, which we must realize in its total broad meaning.

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EAST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

GDR CHEMICAL EQUIPMENT COMBINE COOPERATES WITH SCIENCE ACADEMY

East Berlin SPECTRUM in German No 7, 1986 pp II-III

[Interview with Director of Research of the VEB Chemical Equipment Construction Combine Prof Dr of Economic Science Robert Kunze and Deputy Director of the Institute for Biotechnology Dr of Natural Sciences Lothar Clauss by Sonnhild Kutschmar: "Science Must Get Involved in the System!"; date and place not given]

[Text] [Question] In his speech to the 11th SED Party Congress, Academy President Werner Scheler characterized science and technology as crucial catalysts for production. What is the Institute for Biotechnology doing in this regard?

Dr Clauss: I consider this comparison of science with a catalyst very appropriate. We are attempting to achieve such a function through innovative methods in the organization of scientific activities and political motivation of our colleagues. The goal is to reach a new quality of cooperation with the combines. The contracts concluded in recent months with industry also demonstrate that the demands of industry on the academy have increased.

[Question]: In what way?

Dr Clauss: In the past we devoted ourselves--generally over relatively long periods of time--to problems which later became relevant for practical application. Now concrete demands are made on science and at the same time the combines are obligated to implement biotechnological processes. Our cooperative partner, the Leipzig/Grimma VEB Chemical Equipment Construction Combine, is virtually the exclusive manufacturer of chemical devices and equipment in the GDR. We have struck specific agreements with it, e.g., for development and construction of highly efficient, computerized fermenters. An example of a new area of application is the utilization of microorganisms which thrive under extreme conditions and effect metabolic changes at temperatures of between 70 and 100 degrees centigrade. We must jointly develop the types of fermenters essential for this. From time to time, the collaboration of researcher and engineer proceeds too slowly to suit us. I still see reservations here.

[Question]: How do you respond to this impatience, Professor Kunze?

Professor Kunze: The remark of our chairman Gert Wohllebe with which you have titled this interview certainly makes clear that we in the combine have correctly interpreted the signs of the times. The construction of chemical equipment is the link between research and the chemical industry. To avoid becoming a bottleneck, we have established cooperation with academic institutes as our priority for the chemical industry's 5-year plan. If we want to be able to manufacture using modern equipment in 1990 or 1995, we have to begin basic research now at the latest. Therefore, it was necessary for us to establish our own biotechnology research department within the combine. It is specifically devoted to the planning of biotechnological equipment. That is certainly a step toward countering the impatience of our scientific partner.

[Question]: What innovation does the coordination contract between the Chemical Equipment Construction Combine and the Science Academy present?

Professor Kunze: The Leipzig Institute for Biotechnology is not our only academic partner. Outstanding cooperation also exists with the Institute for Chemical Technology and the Central Institute for Organic and Physical Chemistry. An example of innovation is that we as a combine are currently constructing the experimental substructure for the Academy of Sciences in Berlin. Our planners and assemblers are working with the requirement of faster transfer of the results of basic research to applied research. This also has a positive effect on the scientists' sense of responsibility because they are cooperating more directly in economically significant tasks. We are thus jointly attempting to replace the delineation between research and the transition to manufacturing with a smooth transfer.

[Question]: But where do problems remain?

Dr Clauss: As so often happens, the devil interferes in the details. For example: A pilot system for the manufacture of biogas was jointly installed in Delitzsch near Leipzig with great personal support from chairman Gert Wohllebe. Under normal circumstances, research and development for it would have taken from 5 to 6 years. We managed it in 1 year through flexible research, planning, and transfer. The system was finished at the same time as our G 4-stage [not further identified]. But, because some of the necessary measuring devices were not available at the same time, it could not immediately operate at full capacity.

Professor Kunze: Research themes are not supposed to be pursued for more than 2 years in industry. That is the law. To make that a reality, for years we have fostered our own means of rationalization and have based them on microelectronics. To mesh science and production more closely, we are increasingly producing prototype devices for research. It is however essential that all combines and supply firms commit themselves more fully; then the system in Delitzsch will soon have the necessary measuring devices available.

[Question]: Without highly developed process technology the ambitious goals of the 11th Party Congress cannot be reached. What preliminary development

does the combine need from biotechnologists for this?

Professor Kunze: In certain areas of application the most significant argument in favor of biotechnology is the gigantic growth in productivity in contrast with conventional chemical manufacturing processes. To fully exploit this advantage, we demand from basic research the selection of high-yield strains. These include, for example, microorganisms which can produce 50-percent citric acid--without bothersome by-products.

Dr Clauss: We have been able to produce 50-percent citric acid for a long time. By selection and chemical process optimization we now have a yeast strain which produces only a 5-percent share of the undesirable isocitric acid. However, the new demands on us biotechnologists are not limited to microbiology or methodology. With the help of modern means of processing we have to make processes more economical. For this, computerized fermenters, highly developed measurement techniques, and innovative hardware and software are necessary. The jointly developed processes need to function with reduced outlays of manpower and energy. That is the only way that the doubled productivity demanded by the Party Congress can be achieved.

[Question]: By 1990--according to the directive--the production of the Chemical Equipment Construction Combine is to be raised by 7 percent. How can that goal be achieved?

Professor Kunze: First of all: Biotechnology is included in this 7 percent. At the beginning of this year, we already accomplished one prerequisite for reaching the goal with the foundation of the Science-Industry Biotechnology Cooperative. With the help of this establishment the scientific and technical potential of the Leipzig area, i.e., of the Karl Marx University and of the Academy Institute, is to be applied in a more concentrated manner for the elaboration of readily transferable solutions. On the laboratory and technical college level, short-term interdisciplinary collectives are testing new methods, such as cell culture technology. With their experiments they are doing the preliminary work for readily transferable equipment. Projects now in progress are the recovery of lysine, an amino acid which constitutes a significant amendment for feed grains, and the aforementioned citric acid.

Time plays an increasingly significant role in scientific activities, and from now on we must reorganize previously sequential steps from basic research all the way to its transfer to production with the greatest possible parallelism. The recent development of a new type of pressurized fermenter at the Institute for Biotechnology demonstrates that a rethinking process has also caught hold with our partner. Discussion with colleagues from our combine is stimulating them to produce documents of high quality which permit us a rapid transition to production. This naturally strengthens our confidence in the partnership.

[Question]: Biotechnological production is supposed to increase by a factor of three by 1990. What consequences does that entail for the Institute?

Dr Clauss: It is our job to assist in the rationalization and intensification of current biotechnological production. In addition, we are promoting new trends such as the synthesis of lysine, citric acid, and gluconic acid, a

product which is essential for the beverage and detergent industries. We developed the process for production of gluconic acid with the Bitterfeld Chemical Combine, and with the Chemical Equipment Construction Combine we are currently in the process of clarifying the problem of the most effective reactor type needed for it. Our institute is concentrating on the microbial recovery of metals such as tin, copper, and silver from slag heaps and garbage. We have already reported on this trend--geobiotechnology--in SPECTRUM (No 4, 1986). We have to develop new apparatus for these processes. Here again science will act as a catalyst in the sense mentioned at the beginning of the article.

[Question]: How are the employees of the Academy Institute and the Chemical Equipment Construction Combine promoting science's commitment?

Dr Clauss: I am head of the Biotechnology Working Group of the Regional Committee of the Chamber of Technology. We have set three tasks for ourselves: post-graduate education in the area of biotechnology for the managerial cadres and technical engineering personnel; implementation of informational congresses on various problems, such as sterile technology or biogas and alternative sources of energy; and exchange of experience. We work closely with the operations section of the Chamber of Technology of the Chemical Equipment Construction Combine and are attempting to develop increasing interest in biotechnology.

Professor Kunze: We are particularly concerned with students and encourage their inclination toward chemistry by giving the interested students from the 9th and 10th classes of the Grimma area the opportunity to become familiar with the technology in the combine every 14 days. In this way we are attempting to cultivate a qualified next generation. We are the industrial partner of the special school for mathematics and natural sciences, the Humboldt School in Leipzig. Students from the Karl Marx University are taken care of in the sciences. In addition, we have the tradition of recognizing, on Chemical Workers' Day, the best scientific-technical achievement introduced into production. Furthermore, for a year now our chairman has been recognizing the best single achievement in each of the areas of biotechnology, microelectronics, process engineering, and plant construction technology with an honorary plaque bearing the image of Ostwald.

#### PHOTO CAPTIONS

1. p II. Prof Dr of Economic Science Robert Kunze, Director of Research of the VEB Chemical Equipment Construction Combine
2. p II. Dr of Natural Sciences Lothar Clauss, Deputy Director of the Institute for Biotechnology
3. p III. High-tech pilot system in the strain culture section of the Grimma Chemical Equipment Construction Combine

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